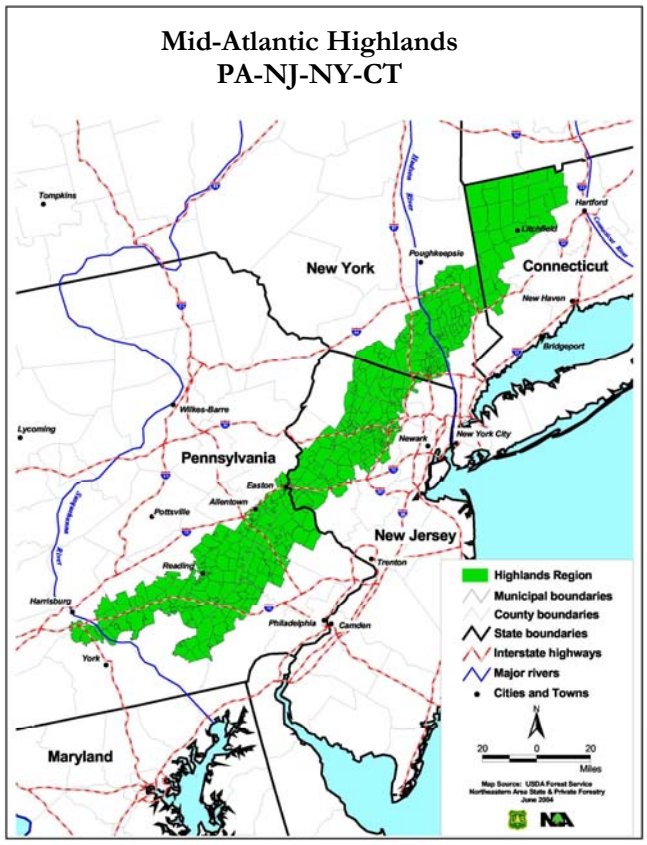
II THE HIGHLANDS REGION, HISTORY AND CURRENT CONDITIONS

A. SIGNIFICANCE OF THE HIGHLANDS REGION

The Highlands Region is part of the four-state Mid-Atlantic Highlands system (Mid-Atlantic Highlands). The Mid-Atlantic Highlands consists of over 3.5 million acres of land including portions of Connecticut, New York, New Jersey, and Pennsylvania (See figure *Mid-Atlantic Highlands).*

The Mid-Atlantic Highlands provide an important source of drinking water to some of the most densely populated portions of the United States extending between the major metropolitan areas of Philadelphia, Newark, New York and Hartford. The Mid-Atlantic Highlands includes rolling hills, pastoral valleys, clean potable water sources, diverse forests, critical wildlife habitat, and historic sites, all of which are located within easy access and provide important recreational opportunities to more than 25 million people.



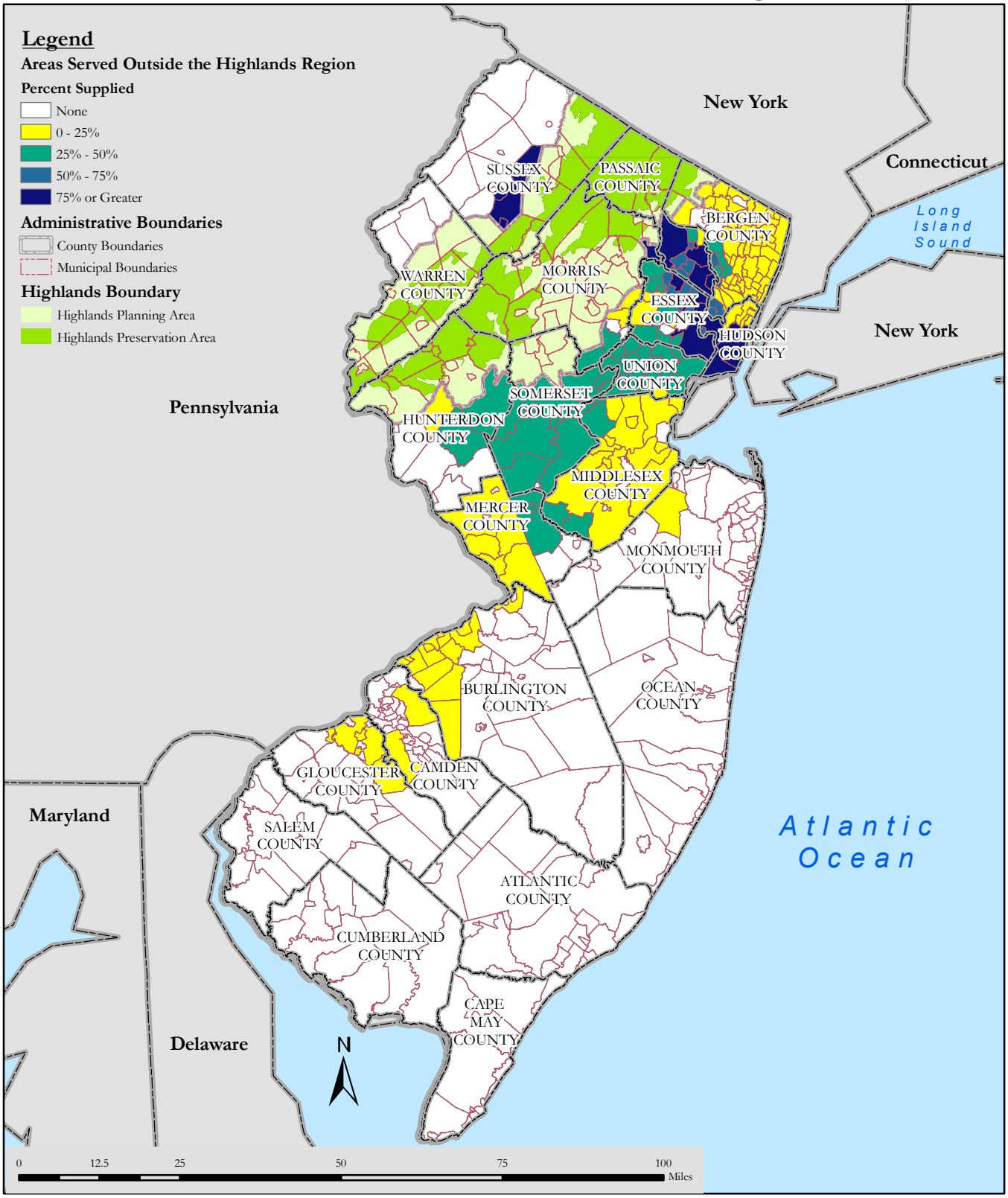
As a result of its close proximity to the New Jersey/New York metropolitan area, New Jersey's portion of the Mid-Atlantic Highlands is under significant development pressure, which is placing increasing demands on the State's finite drinking water supplies. The figure *Areas Served by Highlands Water* depicts those areas in New Jersey whose drinking water is supplied by the Highlands Region. In addition to the more than 800,000 people living in the 88 municipalities that comprise the New Jersey Highlands Region (Highlands Region), the northeast New Jersey metropolitan area largely depends on the Highlands Region for its drinking water supplies. In total, approximately five million New Jersey residents rely on Highlands water. Projections indicate that at the current pace of development, the future demand for water through 2030 may exceed the safe yields (the amount of water that can be safely withdrawn from a reservoir over time) of several reservoirs in the Highlands Region.

The value of the Highlands Region has been recognized and studied by both State and Federal agencies for over 100 years. Of particular importance are the findings of the New Jersey Potable Water Commission report issued in 1907, a United States Department of Agriculture Forest Service study conducted in 1992 and updated in 2002, and the recommendations of the 2003 New Jersey Highlands Task Force.

1. 1907 Potable Water Commission Report

On March 7, 1906, New Jersey Governor Edward C. Stokes approved Joint Resolution No. 2 of the Senate and General Assembly establishing a five-member commission "to investigate the practicability and probable cost of the acquisition by the State of the title to the potable waters of the State." The Potable Water Commission's task was to examine the extent, character, ownership, and value of the State's potable water supplies.

Areas Served By Highlands Water



Draft Regional Master Plan, November 2006

Highlands Council
New Jersey

Sources:
New Jersey Highlands Council, 2006
New Jersey Department of Environmental Protection, 2006

The Commission reported its findings in 1907, which acknowledged the uneven distribution of potable water sources throughout the State. The report indicated that, while an abundant natural supply of potable water may be available, the people of the State had the responsibility to use it wisely and prevent it from contamination for the existing population and future generations. The Commission noted the importance of the Highlands watersheds in its report explaining:

> *The Highlands watersheds are the best in the State in respect to ease of collection, in scantiness of population, with consequent absence of contamination; in elevation, giving opportunity for gravity delivery and in softness as shown by chemical analysis. These watersheds should be preserved from pollution at all hazards, for upon them the most populous portions of the State must depend for water supplies. There has been too much laxness in the past regarding this important matter.*

The report suggested that the State acquire lakes or ponds over 100 acres in size for the purpose of public recreation such as boating and fishing in order to keep them accessible for the public use. The Commission highlighted lakes in Sussex, Morris and Warren Counties for their pristine waters and scenic beauty for recreational purposes. While the Commission's report promoted the development of water supply management in New Jersey over the next century, governmental action focusing on the importance of protecting the Highlands was not taken until the end of the century when the federal government became involved.

2. United States Forest Service Study

Federal involvement began in 1990 with the passage of the Food, Agriculture, Conservation, and Trade Act of 1990, which authorized the Secretary of Agriculture "…to conduct a study of the region known as the New York-New Jersey Highlands…" The study's objectives were to:

- define the physiographic boundaries of the region;
- identify forest, ecological and economic resources;
- identify historical land ownership patterns;
- indicate the likely impact of change;
- propose alternative conservation strategies; and
- provide the opportunity for public comment.

As a result of the study, the U.S. Forest Service (in cooperation with New York and New Jersey representatives) issued a report in 1992 and an updated report in 2002. The U.S. Forest Service study served as a significant impetus to reigniting the effort to protect the critical natural resources of New Jersey's Highlands Region.

The 1992 New York-New Jersey Highlands Regional Study (1992 Study) analyzed approximately 1.1 million acres of ridges and valleys from the Hudson River in the east to the Delaware River in the west, encompassing a study area that included portions of two counties in southern New York State and seven counties in the northwest part of New Jersey.

The U.S. Forest Service identified unprecedented development pressure from commercial, industrial and residential uses in the study area and concluded that this pressure was causing the loss of natural and cultural heritage, agricultural lands, wildlife habitat, and recreational opportunities, in addition to deteriorating the air quality and the quality of the region's drinking water supplies. The 1992 Study stated that "[t]hese changes place the extraordinary and essential resources of the Highlands at risk."

The results of the 1992 Study, which were later reiterated in the 2002 update, listed five major goals to protect the region's water resources:

- Goal 1: Manage future growth compatible with the region's ecological constraints;
- Goal 2: Maintain an adequate supply of quality water;

- Goal 3: Conserve contiguous forests;
- Goal 4: Provide appropriate recreational opportunities; and
- Goal 5: Promote economic prosperity that is compatible with goals 1-4.

The 1992 Study examined the following resources in a regional context: forest resources, groundwater, surface water, fish and wildlife, recreation; agriculture; biological communities; threatened and endangered species; geophysical characteristics; air quality; cultural resources; forest land ownership and forest losses; and population growth and land use change. The 1992 Study concluded that there would continue to be negative impacts on the region's natural and cultural resources unless numerous conservation measures were employed.

The conservation measures recommended in the 1992 Study included:

Information Distribution and User Education - educational practices that seek to improve the environment and quality of life. Some examples included:

- Land ethic message for landowners;
- Education regarding the value of open space;
- Education concerning the economic value of quality of life issues;
- User education on importance of management of natural resources;
- Technical support and training for local officials;
- School programs with Highlands Region curriculum;
- Highlands educational programs for the general public;
- Education and awareness programs on water quality protection; and
- Education and awareness programs on importance of air quality.

Land Acquisition - including practices regarding the purchase, lease or donation of land, or any interest in land, in order to secure a public benefit. Some examples included:

- Establishment of new federal lands and designations such as National Forests, Parks, Wildlife Refuges, Recreation Areas, neotropical bird reserves, conveyance of insolvent lands via the Resolution Trust Corporation, national reserves, and World Heritage Treaty designations;
- Acquisition of new State lands such as State parks, forests, wildlife management areas, and establishment of land trusts;
- Acquisition of local lands for the creation of new county and municipal parks; and
- Acquisition of land through conveyances to public agencies, conveyance to a local land trust, nonprofit ownership and/or management and nonprofit saleback and/or leaseback.

The 1992 Study also discussed many ownership and transfer of title options including, but not limited to, fee simple acquisition, conservation easement, outright land donation and land exchange. Funding options discussed in the 1992 Study included, but were not limited to, federal and state cost sharing programs, general fund appropriations, and private money donations.

Planning - including all practices that employ the principles of planning and design, project review, and land and resource regulation. Some examples included:

- Zoning and subdivision for environmentally sensitive development, cluster zoning, performance zoning, carrying capacity zoning, preservation overlay zoning, exaction (open space or money fees for developers), and conservation density subdivisions;
- Growth controls such as urban growth boundaries, phased growth, development moratoria, transfer of development rights, greenline conservation areas, community improvement and urban livability projects, and regional planning; and

- Environmental review which includes, but is not limited to, federal and/or State regulatory review, local environmental ordinances and environmental commission review.

Incentives - including financial or other benefits to landowners that employ land management strategies that produce some public benefit. Some examples included:

- Tax treatment of conservation land sales;
- Credits for investing in a resource-based industry;
- Credits for investing in forest lands;
- Direct incentives and land conservation grants; and
- Payment in lieu of taxes.

In 2002, the U.S. Forest Service conducted a ten year update of the 1992 Study. The 2002 Update expanded the study area to encompass other essential at risk lands to the Connecticut border and parts of two additional New York counties. Together, these additions increased the study area to approximately 1.5 million acres. As in the 1992 Study, the U.S. Forest Service explained that the expanded study area is of national significance because it contains large areas of public open space, provides quality drinking water for millions of New York and New Jersey residents, has numerous and large areas of wildlife habitat, is an integral part of the Appalachian Mountain chain, and is an historical link for both the American Revolutionary and Civil Wars.

The 2002 Update documented an overall 11% increase in population from 1990-2000. Revising the 1992 Study's conclusions to reflect this increase, the U.S. Forest Service ran various development scenarios to determine the possible extent and pattern of changes to the Highlands landscape over time. The scenarios illustrated the consequences from the likely market reactions to the zoning laws and regulations in effect at that time. For example, the 2002 Update showed how much forest had been converted to developed areas and projected the likely future trends by examining how many houses could potentially be built under existing State laws and local zoning.

The 2002 Update also identified numerous conservation successes since 1992. These successes included, but were not limited to:

- Acquisition of 20,000 acres in Sterling Forest on the New York-New Jersey border; and 2,600 New Jersey acres and 847 New York acres protected through the USDA Forest Service's Forest Legacy Program;
- Acquisition of 80,000 acres protected through state, county, local and private sector support for open space acquisition;
- Designation of the Highlands Region as New Jersey's first Special Resource Area in the State Development and Redevelopment Plan; and
- Designation of the Highlands Region as a unique physiographic province in the New York State Open Space Plan.

Importantly, the 2002 Update reiterated a recommendation from the 1992 Study to "[e]stablish a permanent regional entity, a Highlands regional council, to oversee the planning and management of the 1.1 million acre Study Area." The Forest Service emphasis on the necessity of implementing a holistic approach to preserving the complex ecological and social characteristics of the Highlands Region served as an impetus to establishing the New Jersey Highlands Task Force in 2003.

3. Highlands Task Force Action Plan

On September 19, 2003, Governor James McGreevey issued Executive Order 70 establishing the Highlands Task Force (Task Force). The 19-member Task Force was charged with making recommendations to the Governor and Legislature regarding ways to protect and enhance the quality of life in the Highlands Region by addressing measures to preserve natural resources while simultaneously providing opportunities for economic growth.

In March, 2004, the Task Force presented an action plan to the Governor and Legislature which included the following recommendations along with detailed associated tasks:

- Identify a Preservation Area in the Highlands;
- Enhance environmental protections in the Preservation Area;
- Create a Highlands drinking water protection and regional planning council;
- Enhance the land preservation program in the Highlands;
- Mobilize state agencies into concerted action to protect the Highlands; and
- Collaborate with the other Highlands states.

As a result of the recommendations of the Task Force, the Highlands Act was enacted on August 10, 2004 and charged the Highlands Council with the important task of developing a Regional Master Plan for the Highlands Region.

B. HISTORY OF THE HIGHLANDS REGION

1. Early Settlement of the Area

The natural environment has transformed gradually since the final retreat of the Wisconsin Glacier around 10,000 BC. After the Ice Age, the Highlands contained tundra-like vegetation which, over time, succeeded to grasslands and eventually the forests that dominate the Highlands Region today. Since the terminal moraine of the glacier was located south of the present day location of Route 80 - between Morris and Warren Counties - differences exist in the topography and soils between the northern and southern portions of the Highlands. The northern portion had steeper slopes, was rockier, and had narrower valleys than the southern portion. South of where the glacier ended;, the soils were richer and better suited for agriculture.

Evidence of early human habitation has been found throughout the Highlands Region, including artifacts related to Native American culture. The earliest known period of human occupation by the Paleo-Indians occurred just after the glacial retreat, between 10,000 BC and 8,000 BC. Archeologists believe that the Paleo-Indians were primarily hunters and gatherers traveling in small groups that set up small temporary camps. One of the most significant Paleo-Indian settlements identified in the entire Northeast is the Plenge site located in Warren County along the Musconetcong River. The Highlands Region offered many positive settlement aspects including good river or spring fed water bodies for drinking water, quality rocks for tool making, and accessible food supplies such as game animals and berries.

During the time period between 8,000 BC and 1,000 BC, the settlements of native populations became larger and more permanent in nature. Evidence of settlements dating back to this period has been found at the Mountainside Parks site in Pompton Plains and the Monksville Reservoir area of Ringwood and West Milford.

Between 1,000 BC and 1,600 AD, known as the Woodland Period, the native populations became more sedentary. Clay was molded and fired into pottery containers for cooking and eating. Bows and arrows and tobacco pipes have also been connected to settlements of this time period. While the native population depended on hunting and gathering as a source of their food, the large permanent settlements progressed to the point of establishing subsistence farm plots that included vegetables such as squash, maize, and beans. They continued to settle in the large river valley floodplains that provided fertile soils to meet their needs. Archaeologists have found artifacts from this time period at a site near Holland Church in Hunterdon County.

2. Arrival of European Settlers

During the late Woodland Period (circa 1600 AD), European settlers arrived in the Highlands Region. They settled in the fertile valleys near the rivers. It is believed that some of the farming techniques used by the native populations enabled the Europeans to settle the area, particularly the use of fire to clear fields and create paths. The settlers found these paths beneficial since they made traveling through the Highlands less cumbersome. Along these choice routes, European settlers were attracted by the pristine water, fertile soil, and the Region's beauty, and many decided to establish roots proximate to the native population settlements.

3. The Industrial Age

The Highlands of the 1700's and 1800's was markedly different from earlier periods. European settlers, primarily of German and Irish descent, settled in the northern Highlands in industry-related villages. The key industry of the region became ironworks. Factors contributing to this industry, included the Region's geology and the availability of natural resources. The Highlands was found to contain one of the richest iron oxide deposits in the world. Iron oxide, also known as magnetite, is an iron ore with the highest iron content. The area also had readily available sources of water and lumber which were needed to process the raw ore into metallic products. The Mt. Hope Mine in Rockaway Township, Morris County is believed to be one of the oldest and largest iron mines in the United States, dating back to 1710 and yielding close to 6 million tons or iron ore during more than 250 years in operation.

The onset of industrialization brought many changes to the Highlands Region. People settled in a more permanent fashion since many employees were needed to run the ironworks operations. The communities that sprouted up around the industries included structures for housing, work (e.g. mills, offices), civic activities (e.g. churches, schools), and commerce (e.g. stores, inns). Significant structures related to the ironworks industry included furnaces and forages. These ruins may be seen in several Highlands towns today.

Dramatic changes to the natural environment also took place during this era. Initially, ore was mined from surface rock, but over time numerous mines were established throughout the Highlands. A reliable water supply was needed since water power was used in the operation of many iron mines. Additionally, charcoal was used as a fuel source to fire the industry's furnaces and forges. The vast forests of the northern Highlands provided an abundant source of timber for producing charcoal, which in turn lead to significant forest loss.

Industrialization of the area demanded better transportation networks to move raw materials and goods. Transportation advancements occurring during this period included the construction of the Morris Canal and expansion of railroads. The Morris Canal was completed in 1830 to connect Newark and the Hudson River to the Delaware River. The canal saved the early fall of the iron industry in New Jersey by providing coal from Pennsylvania as a source of fuel for the forges. Coal was shipped to the Highlands to supplement the waning Highlands timber supply. Railroad expansions that followed enhanced the ability to transport fuel and processed iron.

4. Newark Watershed

By the mid-1800's, Newark was an industrial giant in New Jersey. With a prime location that included port facilities,

a good roadway network, the Morris Canal, and new railroad access, Newark attracted many lucrative businesses. Breweries, mills, a major fertilizer company, a power plant, and industries that manufactured leather into finished goods employed many local residents. Newark's progress was being recognized for its economic boom, but it became obvious by the 1850's that it was experiencing dramatic resource problems, particularly with regard to drinking water.

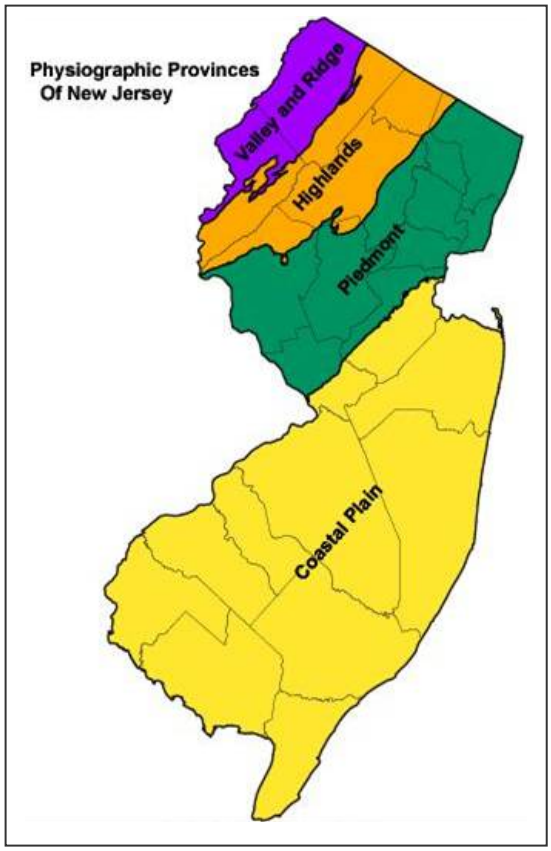
In 1860, the City purchased the Newark Aqueduct Company to meet part of Newark's growing need for clean water. During the 1870's, Newark's use of water from the Passaic River, which bordered the city to the east, was brought into question. Official reports contain notations that the water was "highly offensive to both smell and taste," contained "a shocking degree of contamination," and had a "filthy appearance." The Passaic River water was simply too polluted to drink. Life-threatening diseases related to contaminated water supplies, such as typhoid, plagued the city. Compounding the problem, an 1885 survey showed that 75% of all private wells in Newark, including the municipal pump, contained unhealthy levels of pollutants.

In 1879, the City of Newark looked to the pristine waters in the hills of Passaic County and the Pequannock River for a new, long-term supply of clean drinking water. When Mayor Joseph E. Haynes was elected in 1883, he stated "The importance of an abundant supply of pure water cannot be overestimated. That from the Pequannock seems the most feasible and best adapted to meet the requirements of our city for the present and having a due regard for the future." Mayor Haynes lead efforts that purchased 35,000 acres of land in the Pequannock River watershed located in Passaic, Morris, and Sussex Counties (a major Highlands Region watershed), and initiated the establishment of reservoirs and water delivery infrastructure. In 1889, East Jersey Water Company entered into an agreement with Newark to construct three reservoirs to provide 50 million gallons of water per day at a cost $6 million. During the first year after the initial flow of potable water arrived in Newark from the Pequannock River watershed, the number of deaths by typhoid in Newark dropped by 70%.

In the early 1920s Newark sought to create another dedicated water supply source along the Wanaque River located in the Highlands. It wasn't until 1930 that construction of the 30 billion gallon Wanaque Reservoir was completed. By this time, the New Jersey Legislature created the North Jersey District Water Supply Commission to serve a consortium of municipalities, including the City of Newark, to address the communities' water supply needs. Over time, Newark purchased additional land in the drainage basin to protect the source of their drinking water. The City of Newark currently owns over 86 percent of the lands in the Pequannock watershed.

C. ENVIRONMENTAL AND LAND USE SETTING

Functioning as a green belt along the East Coast's metropolitan areas, the Highlands Region offers stunning vistas of an ancient landscape and serves as a vital source of drinking water for millions of New Jersey residents. Noted for its scenic beauty and environmental significance, the Region displays myriad geographic and geologic features, including rolling hills, pastoral valleys, steep ridges, diverse forests, critical wildlife habitats, and a rich history.



The Highlands Region is part of the New Jersey physiographic province known as the Highlands Province (See figure *Physiographic Provinces of New Jersey*). The Province is situated on the eastern edge of the Appalachian Mountain chain, which extends from Georgia to Newfoundland, Canada. The other three physiographic provinces found in New Jersey are the Valley and Ridge, the Piedmont and the Coastal Plain. An irregular escarpment, averaging 500 feet in height, extends from Franklin Borough, Sussex County, through Andover Township, Sussex County, to the Delaware River north of Phillipsburg, Warren County. This escarpment forms the Highlands' northern boundary with the Valley and Ridge Province. To the southeast, major faults separate the Highlands' erosion-resistant bedrock to form another prominent escarpment running from Mahwah Township, Bergen County, to Peapack-Gladstone Borough, Somerset County, to the Delaware River near Milford Borough, Hunterdon County. This rift marks the Highlands boundary with the Piedmont Province.

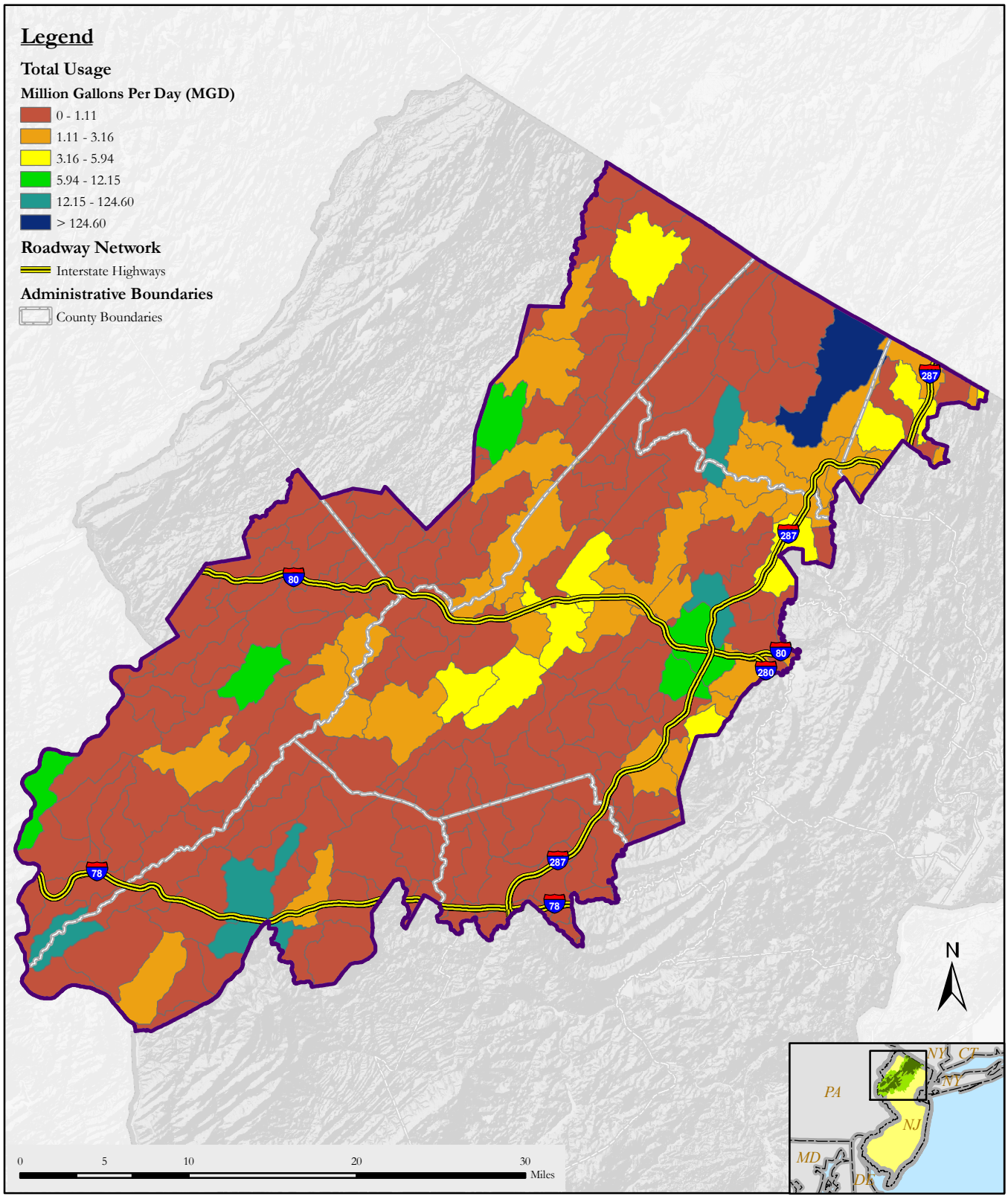
1. Water Supply and Use

The Highlands Region generates in excess of 870 million gallons of water daily (MGD), to meet the needs for potable drinking water, industry and agricultural uses (See table *Highlands Water Uses by Use Type* and *figure Total Water Usage by HUC14*).

The Highlands Region is home to the State's major reservoir systems providing water to urban and suburban areas of northern and central New Jersey (See figure *Source Water* Protection *Areas and Reservoirs*). Currently, each day the Highlands Region provides as much as 770 million gallons of potable drinking water daily to residents both within the Highlands Region and those areas served by Highlands water. The reservoir systems that supply water to major urban areas outside the Region account for the vast majority of potable use, at almost 626 MGD.

During 2003, the reservoirs in the Highlands Region provided 115 billion gallons of drinking water to meet the public water supply service demand that includes the greater New Jersey Metropolitan Area, as well as, portions of Middlesex, Mercer, Burlington, Camden and Gloucester Counties (See figure *Areas Served By Highlands Water*). Given these demands on water resources originating in the Highlands Region, there is a fundamental need to ensure adequate water supplies within the Highlands Region and in those other, heavily populated areas of the State that rely on Highlands waters, while also protecting the Region's important ecological and water resource values.

Total Water Usage by HUC14 (2003)



Draft Regional Master Plan, November 2006

Highlands Council
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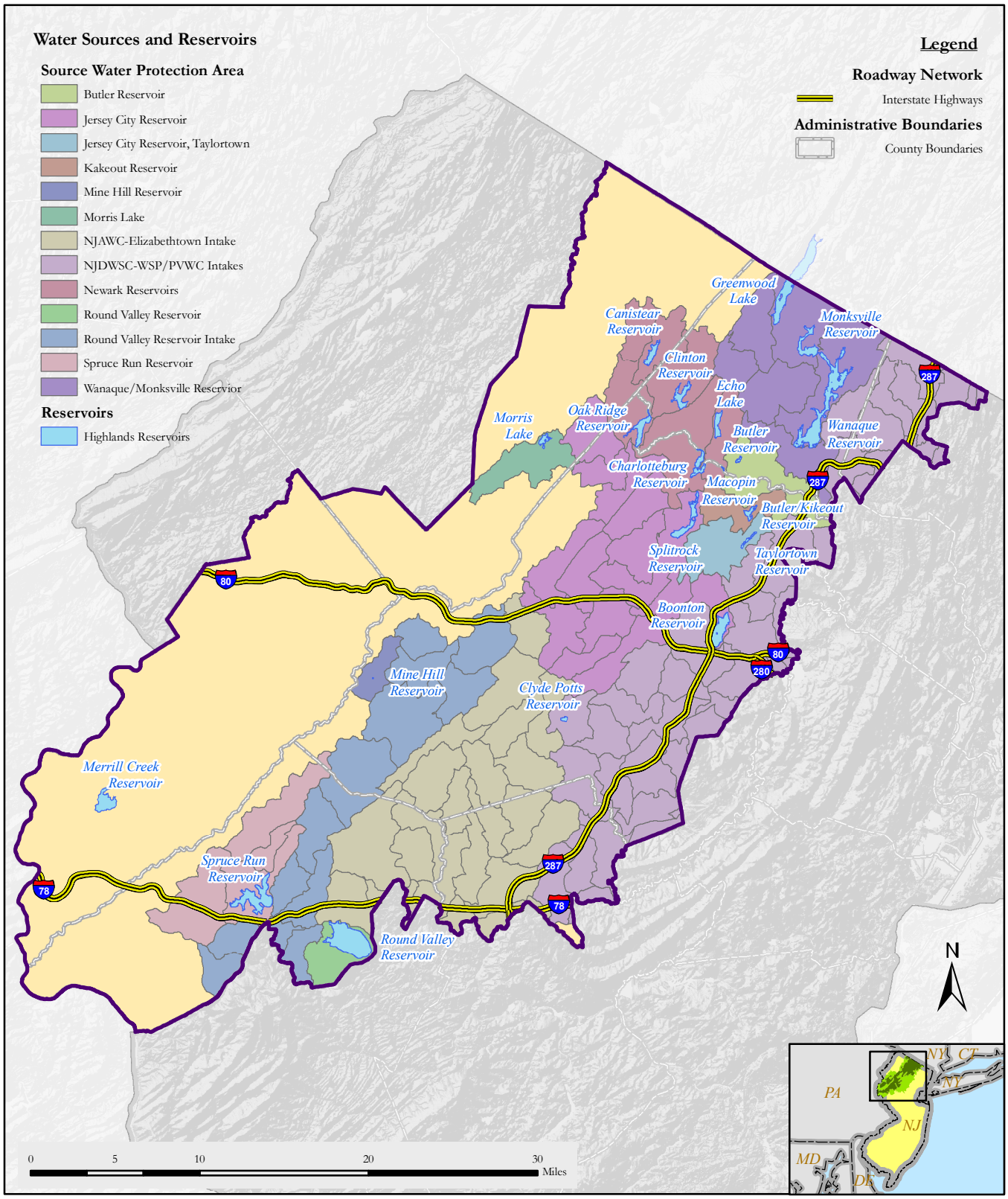
Sources:
New Jersey Highlands Council, 2006

Source Water Protection Areas and Reservoirs



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Highlands Water Uses by Use Type

Use	Use Type	2003 Maximum Monthly Use (Million Gallons Per Day, MGD)			
		MGD	Percent	MGD	Percent
Potable Supply	Domestic	32.7803	3.8%	770.9690	88.5%
	Reservoirs and Intakes	625.8281	71.8%		
	Public Supply –Other	111.5657	12.8%		
	Public Non-Community	0.6801	0.1%		
	Institutional	0.1148	0.0%		
Bottling	--	0.0377	0.0%	0.0377	0.0%
Industrial	Air Conditioning/Cooling	3.7694	0.4%	13.7594	1.6%
	Industrial	9.5249	1.1%		
	Pollution Control	0.4651	0.1%		
Commercial	Commercial	0.1473	0.0%	0.2177	0.0%
	Fire	0.0704	0.0%		
Recreation	--	3.1362	0.4%	3.1362	0.4%
Irrigation	Golf	6.5457	0.8%	6.9350	0.8%
	Non-Agricultural Irrigation	0.3893	0.0%		
Aquaculture	--	12.0013	1.4%	12.0013	1.4%
Agriculture	--	1.5965	0.2%	1.5965	0.2%
Power	Geothermal	0.0171	0.0%	54.5978	6.3%
	Hydroelectric	54.5806	6.3%		
Mining	--	7.7918	0.9%	7.7918	0.9%
Total		**871.0424**	**100.0%**	**871.0424**	**100.0%**

Potable water supplies used within the Highlands Region account for approximately 145 MGD or less than 20% of total potable use. Residents of the Highlands Region get a large amount of their domestic water supply, approximately 33 MGD, from private wells. Public non-community systems serving commercial establishments and institutions (e.g., hospitals and schools) withdraw close to 0.8 MGD. Agricultural uses within the Highlands Region accounts for only 0.2% of total water use.

Only a small portion of the potable water supplied by the major reservoir systems is used within the Highlands Region, as most is exported to other areas of the State. The needs of Highlands residents and municipalities are largely met through withdrawals from groundwater wells tapping local aquifers and with some smaller surface water sources.

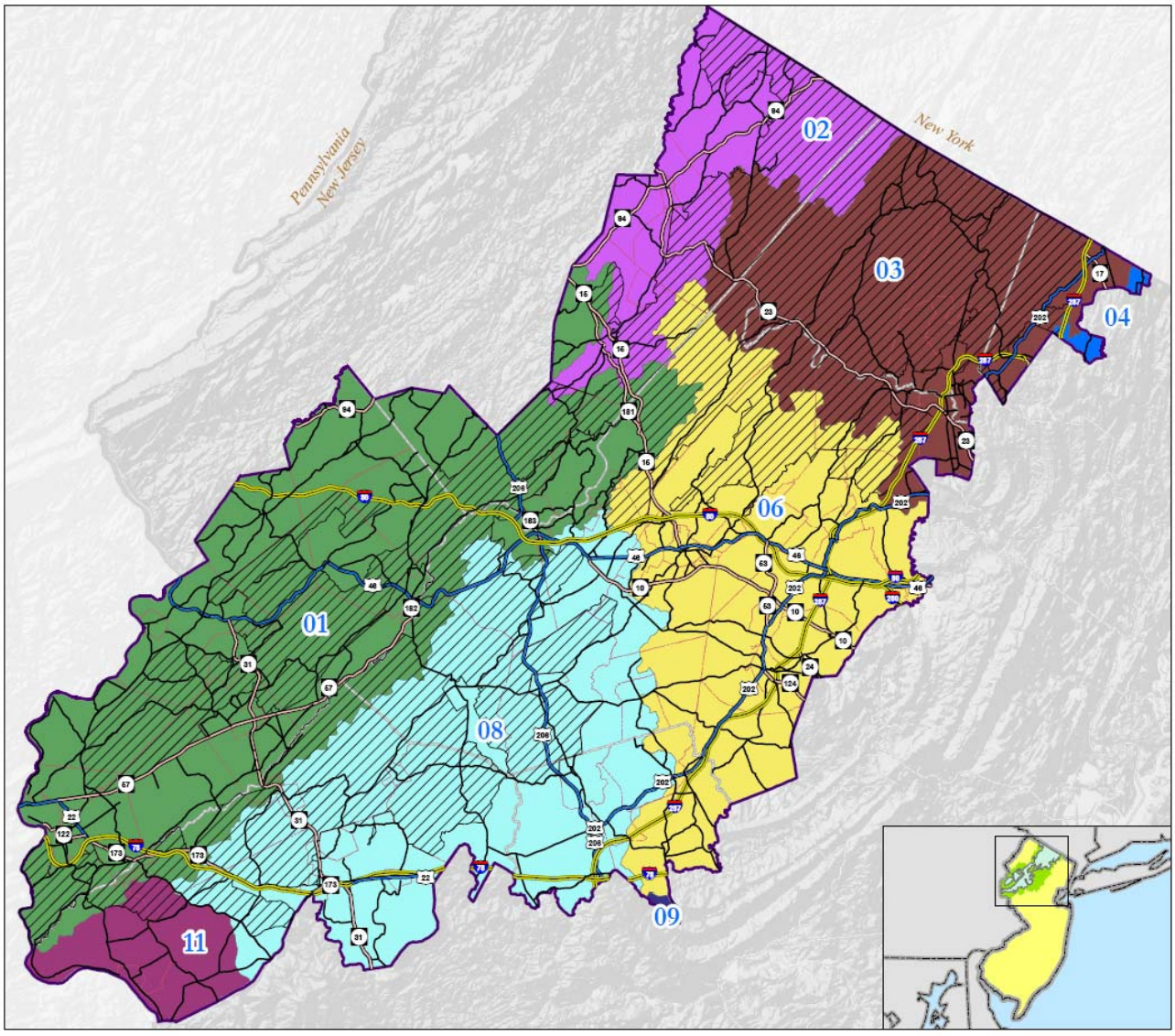
While the Highlands Region's reservoir system currently provides an abundant supply of water, projections of water demands to the year 2030 indicate that several reservoirs in the Highlands Region may have insufficient amounts of water to provide for anticipated future water needs. In collaboration with the Highlands Council, the New Jersey Geological Survey developed projections of population growth to the year 2030 focusing on major public community water systems outside the Highlands Region, yet served by Highlands water. The growth analysis projects that sustainable capacity will be exceeded by major cities like Newark, Jersey City, and Hackensack.

2. Watersheds

The Highlands Council uses the Hydrologic Unit Code (HUC) system developed by the U.S. Geological Survey to describe watersheds. A watershed is an area of land that drains into a body of water such as a river, lake, or stream. The watershed includes both the waterway and the entire land area that drains to it. Each river basin (such as the Passaic River Basin) is comprised of multiple watersheds (such as the Whippany River watershed), which in turn are comprised of multiple subwatersheds (such as the Malapardis Brook subwatershed). There are 183 subwatersheds entirely or partially within the Highland Region which range in size from 3.2 to 21.5 square miles; these are known as HUC14 subwatersheds because their Hydrologic Unit Code has fourteen digits.

In New Jersey, NJDEP has grouped watersheds into Watershed Management Areas. A total of seven Watershed Management Areas (WMAs) are located wholly or partly within the Highlands Region (See figure *Highlands Watershed Management Areas*).

Highlands Watershed Management Areas



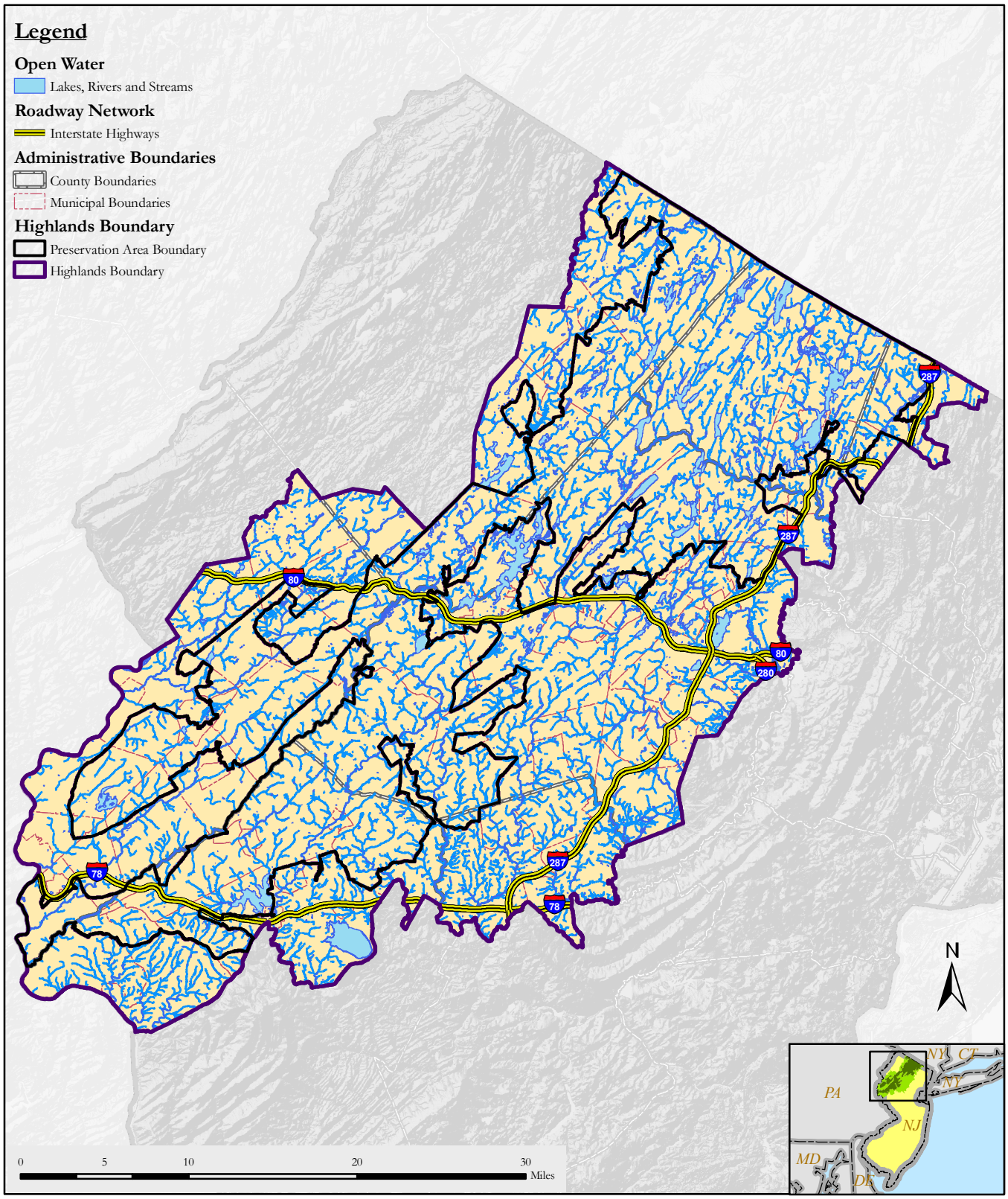
The Watershed Management Areas that occur within the Highlands region include:

- Upper Delaware River (WMA1) – is approximately 746 square miles in total area of which 259,241 acres are within the Highlands Region (30%) including all of Warren County and portions of Sussex, Morris, and Hunterdon Counties. There are five major waterways that drain to the west to the upper reaches of the Delaware River including Flat Brook, Paulins Kill, Pequest River, the Pohatcong-Lopatcong River, as well as the Musconetcong River, a designated Wild and Scenic River.
- Wallkill River (WMA2) - predominantly includes the northern portion of Sussex County and a small portion of Passaic County representing 77,507 acres or 9% of the Highlands Region. WMA 2 encompasses approximately 208 square miles, including the Walkill River National Wildlife Refuge, draining to the north into Orange and Ulster Counties in New York and eventually discharging to the Hudson River. The major waterways within this watershed include the Wallkill River, Pochuck Creek, Papakating Creek, and Rutgers Creek.
- Pompton, Pequannock, Wanaque, Ramapo Rivers (WMA3) - accounting for 135,681 acres of the Highlands Region (16%) that drains to the south and east toward the Atlantic Ocean. WMA 3 is located mostly within Passaic County, and includes portions of Bergen, Morris, and Sussex Counties, an area of over 238 square miles. WMA 3 contains major water supply reservoir systems diverting approximately 89 billion gallons of water per year and includes the Wanaque Reservoir, the largest drinking water reservoir in New Jersey.
- Upper Passaic, Whippany and Rockaway Rivers (WMA6) - lies within portions of Morris, Somerset, Sussex, Union and Essex Counties draining approximately 361 square miles to the east toward the Atlantic Ocean. WMA6 accounts for 163,046 acres (19%) of the Highlands Region and is home to over 0.5 million people. Approximately 42 billion gallons of drinking water are diverted from this WMA, half of which are exported to points east. In addition, about 1.3 billion gallons per year are used for industrial purposes. Approximately half of the total water use is from ground water supplies.
- North and South Branch Raritan (Upper Raritan) River (WMA8) - draining 470 square miles including large portions of Somerset, Hunterdon, and Morris Counties to the south and west toward the Delaware River. The total water use in this WMA exceeds 200 million gallons per day with 60% supplied by surface water. This WMA includes 192,036 acres of the Highlands Region (22%) and includes the Spruce Run and Round Valley Reservoirs with a storage capacity of 11 billion gallons and 55 billion gallons, respectively.
- Main Stem Raritan River (WMA9) - in addition to the main stem of the Raritan River, this WMA also includes Bound Brook, South River and Lawrence Brook. Large portions of Middlesex, Somerset and Monmouth Counties draining to the south and east are included in this watershed, which drains a total of approximately 350 square miles. Only a small portion of this WMA is in the Highlands Region accounting for 803 acres (<1%).
- Central Delaware Tributaries (WMA11) - includes portions of Hunterdon, Mercer and a small area of Monmouth of which 28,403 acres (3%) is within the Highlands Region. This area drains to the south and west to the Delaware River. The dominant land use is agriculture (30%).

3. Waterways

In addition to the major waterways described above, the Highlands Region contains numerous other rivers, streams, lakes, and reservoirs (See figure *Lakes, Rivers and Streams of the Highlands Region*). Since these waterbodies provide drinking water for millions of New Jersey residents, the Highlands Region waters are its most critical resource. The Region includes over 3,600 miles of streams accounting for over 32,000 acres of open waters which include streams, rivers, lakes and ponds. Additionally, the Highlands Region includes more than 90,000 acres of wetlands, important habitat for the region's wildlife and an important filter for the Region's drinking water supplies. Reservoirs in the Highlands Region include the Wanaque, Monksville, Clinton, Oak Ridge, Charlottesburg, Echo Lake, Canistear, Split Rock, Boonton, Round Valley and Spruce Run. Thousands of smaller streams and creeks feed the rivers and reservoirs and contribute to the Region's water quality and quantity. More than 75%, or 2700 miles of streams within the Highlands Region, occur within the Preservation Area and are Trout Production Waters classified as Category 1 (C1)

Lakes, Rivers and Streams



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Sources:
New Jersey Highlands Council, 2006

by NJDEP due to their extraordinary ecological value and as a source of drinking water as such they are afforded one of the highest levels of protection by the State.

4. Aquifers

Aquifers are defined as those geologic formations that can transmit usable amounts of ground water to wells for water supply uses. Five major aquifers within the Highlands Region are classified based on the bedrock or surficial materials that are exposed at or near land surface. These include crystalline, carbonate and clastic rocks, typical of Highlands geologic formations. The Highlands Region also includes sedimentary and igneous rocks of the Newark Basin, along the eastern boundary, more typical of the Piedmont physiographic province. Locally, these bedrock units are overlain by surficial glacial deposits. Each aquifer receives its water from ground water recharge from the land surface, or flow from neighboring aquifers.

Crystalline aquifers are the uppermost (surficial) aquifer in approximately 57% of the area within the Highlands Region. These rock types are most resistant to erosion, forming upland regions and providing the highest elevations and relief typical of Highlands topography. They have limited capacity for large wells and primarily support domestic water supplies for individual residences.

Carbonate aquifers are composed predominantly of limestones and dolomites which account for approximately 17% of the Highlands Region. These rock types are less resistant to erosion, subject to dissolution and therefore are found on valley floors. They can provide significant water supplies, including some of the most prolific wells in the Region.

Clastic aquifers are composed of sedimentary sandstone, shale conglomerates and quartzite, and comprise only 8% of the Highlands Region. These rock types locally overly carbonates in some valleys; the more resistant rocks form predominant northeast-southwest trending ridges known locally as the Green Pond, Bearfort, Kanouse and Bellvale Mountains.

Newark Basin aquifers account for the remaining 17% of the Highlands Region. These rocks are predominantly red sandstones and shales. These formations support wells of variable size, generally supplying more water than crystalline aquifers and less than carbonate or glacial valley aquifers.

Glacial aquifers are composed mainly of unconsolidated sand, silt and gravel form narrow belt-like deposits of small areal extent. The aquifers can comprise channels up to 300 feet thick and provide significant storage and yields of ground water. The largest channels are generally found where the glacial material filled a pre-existing river valley, and are know as valley fill or buried valley aquifers.

Two types of aquifers that occur in the Highlands Region include confined and unconfined aquifers. The shallowest aquifer in an area is generally unconfined meaning there is no impermeable rock or soil layer between the aquifer and the ground surface. An unconfined aquifer receives ground water recharge directly from rainfall or from a lake or stream with which it has a hydraulic connection. The upper boundary of an unconfined or water table aquifer is defined by the water table itself. The water table is not a stationary surface, as it rises and falls depending on the amount of rainfall.

Confined aquifers are located between or below confining rock or soil layers, and are usually found below unconfined aquifers. Confined aquifers are not directly recharged by precipitation, but receive recharge from an unconfined area with which it has a hydraulic connection. Confined aquifers are sometimes called artesian aquifers, as the ground water is under pressure and will flow without pumping if tapped by a well.

5. Vegetation

The Highlands Region contains a wide variety, and some fairly unique, natural land cover types, including both upland and bottomland hardwood forests, evergreen forests, bogs, swamps, meadows and grasslands.

Forests account for over one half the total land area in the Highlands Region. More than 90% of forest vegetation is categorized as one of three cover types: mixed oak hardwood forest, northern hardwood forest, and bottomland hardwood forest (See figure *Forested Areas*). The most common forest cover type in the Highlands Region is a mixed oak hardwood forest (approximately 56%). The most common species found in the mixed oak hardwood forest include red, white and black oak with lesser amounts of shagbark hickory, pignut hickory, tulip poplar, black birch, sassafras, red and sugar Maple. Northern hardwood stands also comprise large areas of the Highlands Region (approximately 23%). Northern hardwood stands are typically dominated by sugar and red maple, white ash, black birch and American beech. Other species include yellow birch, tulip poplar, basswood, and minor oak components. Bottomland hardwood forests comprise a relatively smaller area than the oak and northern hardwood stands (approximately 13%). American elm, green ash, red maple, pin and swamp white oak, and black gum are the dominant species in this freshwater wetlands forest type.

In addition to forested vegetation, the Highlands Region features freshwater marshes, herbaceous wetlands, scrub-shrub communities, old fields, and grasslands. Freshwater marshes and herbaceous wetlands are both associated with lakes, ponds, and slow-moving streams. Freshwater marshes are characterized by "persistent" wetland species (i.e., those that normally remain standing at least until the beginning of the next growing season) such as sedges, rushes, cattails, and common reed. Herbaceous wetlands are characterized by "non-persistent" species (i.e., those that fall to the surface of the substrate or below the water at the end of the growing season) such as arrow arum, pickerelweed, and arrow heads.

Scrub-shrub communities are dominated by woody vegetation that is less than 20 feet tall. They include true shrubs (species such as buttonbush and elderberry), young trees, and trees and shrubs that are small or stunted because of environmental conditions or early stages of succession. Grasslands are lands where grass or grasslike vegetation grows and is the dominant form of plant life. Grasslands provide important habitat, particularly for some bird species such as upland sandpiper and bobolink. Old field is the stage of plant growth between bare ground and forest. Old fields are typically found on abandoned pastures and retired farm fields

6. Wildlife

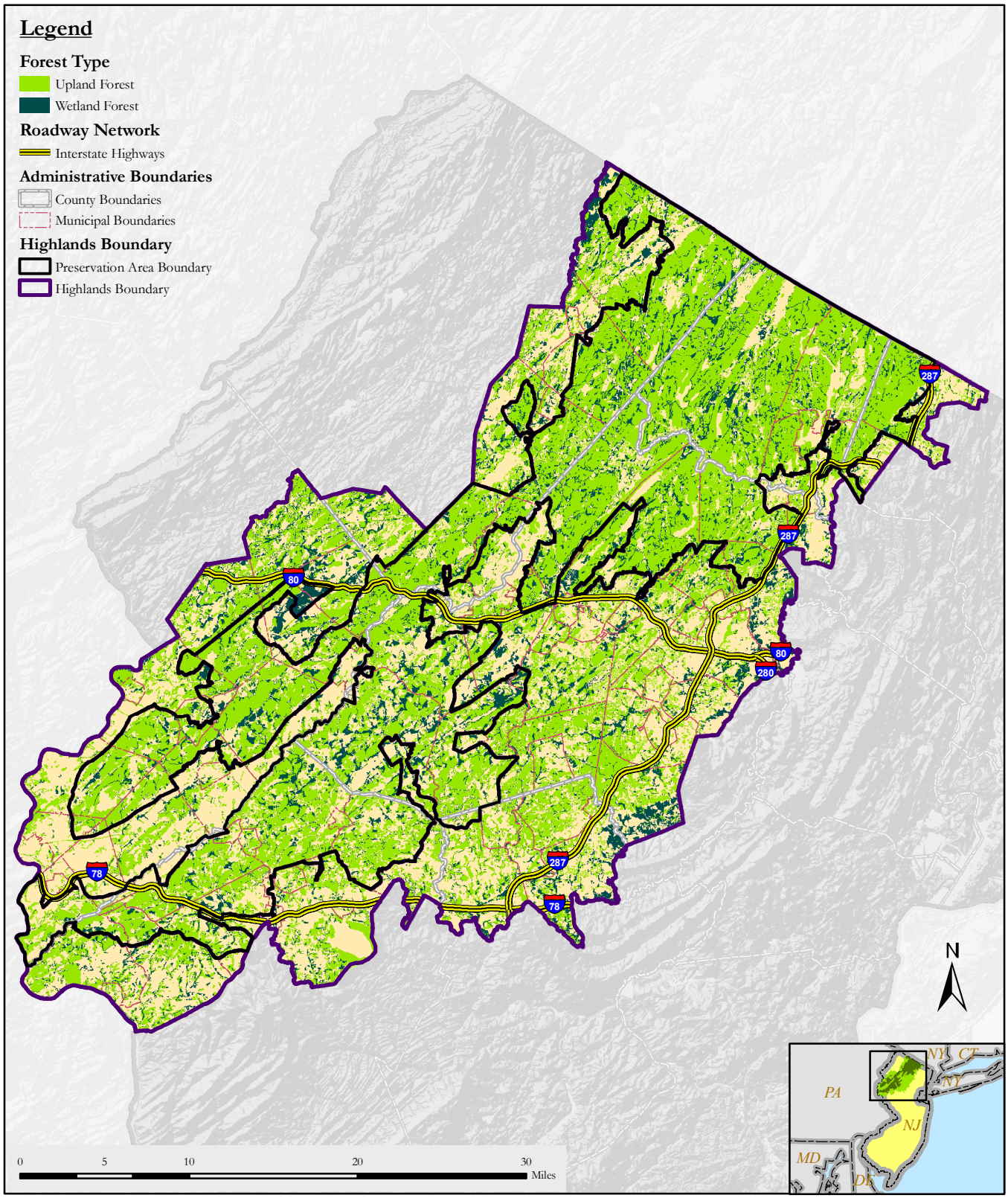
The Highlands Region is home to diverse plant communities and wildlife populations. The tremendous variation in topography, soils and vegetation combined with historically low human population provide optimal conditions for a wide range of wildlife species, many of which are rare, threatened or endangered in the State.

More than 200 species of birds are known to breed, migrate and winter through the Highlands Region. Reptiles and amphibians occupy the varied habitats. Over 30 species of mammals make there home in the Highlands Region including such species as river otter, bobcat and black bear. Some species, such as white tailed deer and Canada goose populations have grown to nuisance levels in many areas of the Highlands.

Water features of the region are a valuable habitat resource. The relatively clean, cold, swift streams provide favorable conditions for aquatic species.

There are 72 wildlife species known to exist in the Highlands Region that are designated as either rare , threatened or endangered by the NJDEP (see table entitled *Rare, Threatened and Endangered Animals that Occur Within the Highlands Region*). Three species (Indiana bat, bog turtle, and bald eagle) are Federally-listed. A total of 34 species are listed as either threatened or endangered in New Jersey, while 35 are designated as rare (i.e., of Special Concern).

Forested Areas



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Sources:
New Jersey Highlands Council, 2006

The Highlands Region contains nearly 860,000 acres and the Highlands Council has determined that nearly 536,000 acres or, over 62% of the Region, includes potential rare, threatened, and endangered species habitats. Of these 536,000 acres of potential habitat within the Region, over 320,000 acres (77%) are in the Preservation Area and over 215,000 acres (48%) are in the Planning Area.

RARE, THREATENED AND ENDANGERED ANIMALS THAT OCCUR WITHIN THE HIGHLANDS REGION

GROUP	COMMON NAME	SCIENTIFIC NAME	STATUS
Amphibian	Blue-spotted Salamander	*Ambystoma laterale*	State Endangered
Amphibian	Jefferson Salamander	*Ambystoma jeffersonianum*	Special Concern
Amphibian	Longtail Salamander	*Eurycea longicauda longicauda*	State Threatened
Amphibian	Marbled Salamander	*Ambystoma opacum*	Special Concern
Amphibian	Spotted Salamander	*Ambystoma maculatum*	Special Concern
Bird	American Bittern	*Botaurus lentiginosus*	State Endangered
Bird	American Kestrel	*Falco sparverius*	Special Concern
Bird	Bald Eagle	*Haliaeetus leucocephalus*	Federally Listed
Bird	Barred Owl	*Strix varia*	State Threatened
Bird	Black Rail	*Laterallus jamaicensis*	State Threatened
Bird	Black-crowned Night-heron	*Nycticorax nycticorax*	State Threatened
Bird	Black-throated Green Warbler	*Dendroica virens*	Special Concern
Bird	Bobolink	*Dolichonyx oryzivorus*	State Threatened
Bird	Canada Warbler	*Wilsonia canadensis*	Special Concern
Bird	Cerulean Warbler	*Dendroica cerulea*	Special Concern
Bird	Cliff Swallow	*Petrochelidon pyrrhonota*	Special Concern
Bird	Cooper's Hawk	*Accipiter cooperii*	State Threatened
Bird	Eastern Meadowlark	*Sturnella magna*	Special Concern
Bird	Golden-winged Warbler	*Vermivora chrysoptera*	Special Concern
Bird	Grasshopper Sparrow	*Ammodramus savannarum*	State Threatened
Bird	Great Blue Heron	*Ardea herodias*	Special Concern
Bird	Henslow's Sparrow	*Ammodramus henslowii*	State Endangered
Bird	King Rail	*Rallus elegans*	Special Concern
Bird	Least Bittern	*Ixobrychus exilis*	Special Concern
Bird	Long-eared Owl	*Asio otus*	State Threatened
Bird	Migrant Loggerhead Shrike	*Lanius ludovicianus migrans*	State Endangered
Bird	Northern Goshawk	*Accipiter gentilis*	State Endangered
Bird	Northern Harrier	*Circus cyaneus*	State Endangered
Bird	Osprey	*Pandion haliaetus*	State Threatened
Bird	Pied-billed Grebe	*Podilymbus podiceps*	State Endangered
Bird	Red-headed Woodpecker	*Melanerpes erythrocephalus*	State Threatened
Bird	Red-shouldered Hawk	*Buteo lineatus*	State Endangered
Bird	Savannah Sparrow	*Passerculus sandwichensis*	State Threatened
Bird	Sedge Wren	*Cistothorus platensis*	State Endangered
Bird	Upland Sandpiper	*Bartramia longicauda*	State Endangered
Bird	Veery	*Catharus fuscescens*	Special Concern

GROUP	COMMON NAME	SCIENTIFIC NAME	STATUS
Bird	Vesper Sparrow	*Pooecetes gramineus*	State Endangered
Bird	Winter Wren	*Troglodytes troglodytes*	Special Concern
Bird	Worm-eating Warbler	*Helmitheros vermivorus*	Special Concern
Bird	Yellow-crowned Night-heron	*Nyctanassa violacea*	State Threatened
Lepidoptera	A Silver-bordered Fritillary	*Boloria selene myrina*	State Threatened
Lepidoptera	Arogos Skipper	*Atrytone arogos arogos*	State Endangered
Mammal	Bobcat	*Lynx rufus*	State Endangered
Mammal	Eastern Small-footed Myotis	*Myotis leibii*	Special Concern
Mammal	Indiana Bat	*Myotis sodalis*	Federally Listed
Mussel	Brook Floater	*Alasmidonta varicosa*	State Endangered
Mussel	Creeper	*Strophitus undulatus*	Special Concern
Mussel	Dwarf Wedgemussel	*Alasmidonta heterodon*	Federally Listed
Mussel	Eastern Lampmussel	*Lampsilis radiata*	State Threatened
Mussel	Eastern Pondmussel	*Ligumia nasuta*	State Threatened
Mussel	Triangle Floater	*Alasmidonta undulata*	State Threatened
Mussel	Yellow Lampmussel	*Lampsilis cariosa*	State Threatened
Odonate	Arrowhead Spiketail	*Cordulegaster obliqua*	Special Concern
Odonate	Brook Snaketail	*Ophiogomphus aspersus*	Special Concern
Odonate	Brush-tipped Emerald	*Somatochlora walshii*	Special Concern
Odonate	Harpoon Clubtail	*Gomphus descriptus*	Special Concern
Odonate	Kennedy's Emerald	*Somatochlora kennedyi*	Special Concern
Odonate	Maine Snaketail	*Ophiogomphus mainensis*	Special Concern
Odonate	Midland Clubtail	*Gomphus fraternus*	Special Concern
Odonate	New England Bluet	*Enallagma laterale*	Special Concern
Odonate	Rapids Clubtail	*Gomphus quadricolor*	Special Concern
Odonate	Sable Clubtail	*Gomphus rogersi*	Special Concern
Odonate	Ski-tailed Emerald	*Somatochlora elongata*	Special Concern
Odonate	Spatterdock Darner	*Rhionaeschna mutata*	Special Concern
Odonate	Tiger Spiketail	*Cordulegaster erronea*	Special Concern
Odonate	Williamson's Emerald	*Somatochlora williamsoni*	Special Concern
Odonate	Zebra Clubtail	*Stylurus scudderi*	Special Concern
Reptile	Bog Turtle	*Clemmys muhlenbergii*	Federally Listed
Reptile	Eastern Box Turtle	*Terrapene carolina carolina*	Special Concern
Reptile	Northern Copperhead Snake	*Agkistrodon contortrix mokasen*	Special Concern
Reptile	Timber Rattlesnake	*Crotalus horridus horridus*	State Endangered
Reptile	Wood Turtle	*Glyptemys insculpta*	State Threatened

7. Topography

The topography of the Highlands Region is that of a broad, rounded, upland plateau dissected by deep, narrow valleys. Numerous hills and mountains rise above the general level of the land. Elevations range from approximately 120 feet above sea level in the lower Delaware River valley, to greater than 1,496 feet at ridges and high plateaus near Vernon in Sussex County. The terrain in the Highlands Province is rugged and includes extensive

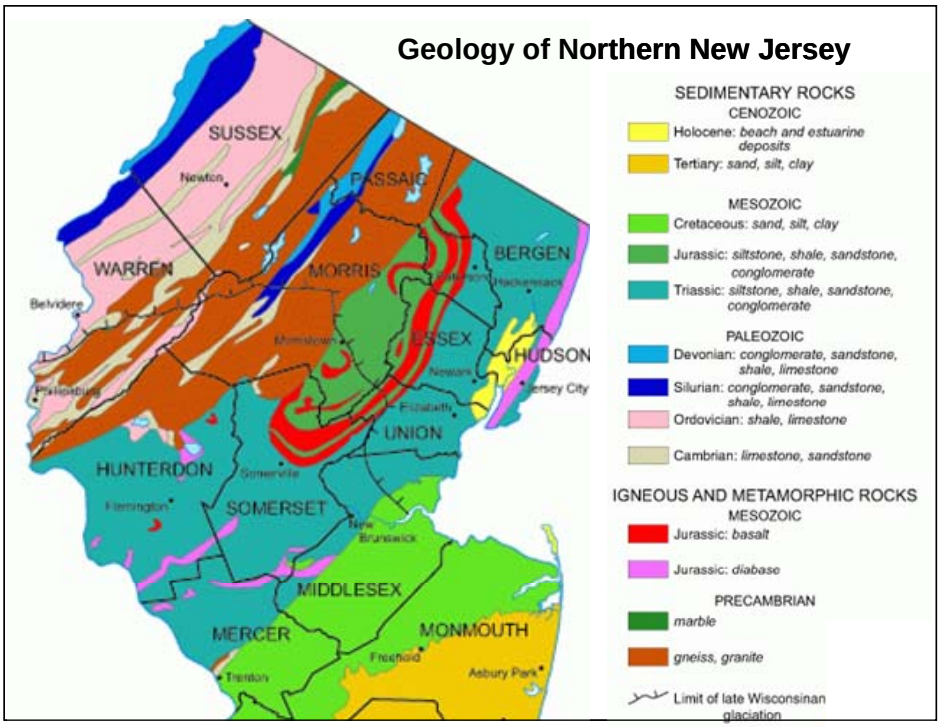
areas of steep slopes exceeding 25%. The erosion-resistant bedrock that creates the hilly upland is interrupted by several elongated northeast-southwest belts of folded, sedimentary rocks. The belts of sedimentary rock form long parallel ridges and valleys (e.g., Bearfort Mountain, Long Valley, and the Musconetcong Valley) that are characteristic of the Highlands.

The northern section of the Highlands Region has been glaciated several times, resulting in very different landscape features south of the glacial extent. The terminal moraine is roughly aligned along Interstate Route 80. Areas to the north of the moraine are more rugged in topography, with rock ridges, steep valleys, and frequent rock outcroppings. The northern section also contains many large, glacially-formed lakes and wetlands, and is generally heavily forested. The southern portion of the Highlands is more gently sloping with more open agricultural lands and early successional vegetation.

8. Geology

The geology of the Highlands Province is a complex pattern of folds, faults, and intrusions (See figure *Geology of Northern New Jersey*). The Highlands bedrock is predominately of Precambrian age and erosion-resistant granite, gneiss, and small amounts of marble. Subjected to high pressure and temperature deep within the Earth, these rocks, the oldest in New Jersey, were formed between 1.3 billion and 750 million years ago. These ancient rocks compose the basement beneath the younger, overlying strata of the Valley and Ridge Province, the sedimentary rocks of the Piedmont Province, and the sediments of the Coastal Plain. The bedrock has been subjected to several stages of intense folding associated with the ancient collision of continental landmasses driven by plate tectonic forces.

The Highlands Region has endured extensive periods of gradual uplift and erosion. As a result, ridges are typically underlain by older metamorphic rocks such as gneisses and schists that are less susceptible to erosion. Stream valleys generally follow along fractured zones and faults, or along outcrop belts of rocks that weather and erode faster. These valleys are typically underlain by limestones, shales, or glacial sediments.



Source: New Jersey Geological Survey (2005)

9. Soils and Glaciation

Like the complex geology beneath it, the soils of the Highlands Region are as varied as the rock material from which they formed. Five factors have influenced the formation of the Region's soils: climate, parent material (i.e. the rock from which soil formed), living organisms, landscape position, and time. If any or all of these factors are changed - through glaciation, for example – a different soil is created. Some features that distinguish soils from one another include depth, texture, color, mineralogy, drainage class, and permeability (a soil's ability to allow water to drain through.

Formation of the Highlands Region's soils has been dominated by glaciation. There have been three major glacial events in the past one million years: pre-Illinoian, Illinoian, and Wisconsian events which occurred approximately 800,000 years ago, 150,000 years ago and 20,000 years ago, respectively. The former edge of the most recent glacier (Wisconsin ice sheet) is marked by a distinctive, ridge-like terminal moraine running approximately east-west along Interstate 80, which effectively marks the line between the glaciated and unglaciated sections.

This most recent glaciation had the effect of creating soil features that differ in the northern section of the Highlands from those soils south of the moraine. North of the moraine, soils tend to be younger as the Wisconsin ice sheet obliterated the pre-existing soil associations, and reset the soil forming process. These northern soils are mostly formed in young glacial till and contain more unweathered material, including gravel, cobbles, stones, and boulders. Glacial lake deposits formed organic soils when lakes served as settling areas for finer clay and silt materials. These areas produced the peat and muck soils found in the Passaic River Basin, the Great Swamp area in Morris County, and the Great Meadows in Warren County. South of the moraine, the soils have not been as strongly influenced by recent glaciation, and tend to develop in weathered residual materials on higher ridges, and from sediments deposited along waterways. These southern soils are older and more weathered generally consisting of less stony material and a higher clay content.

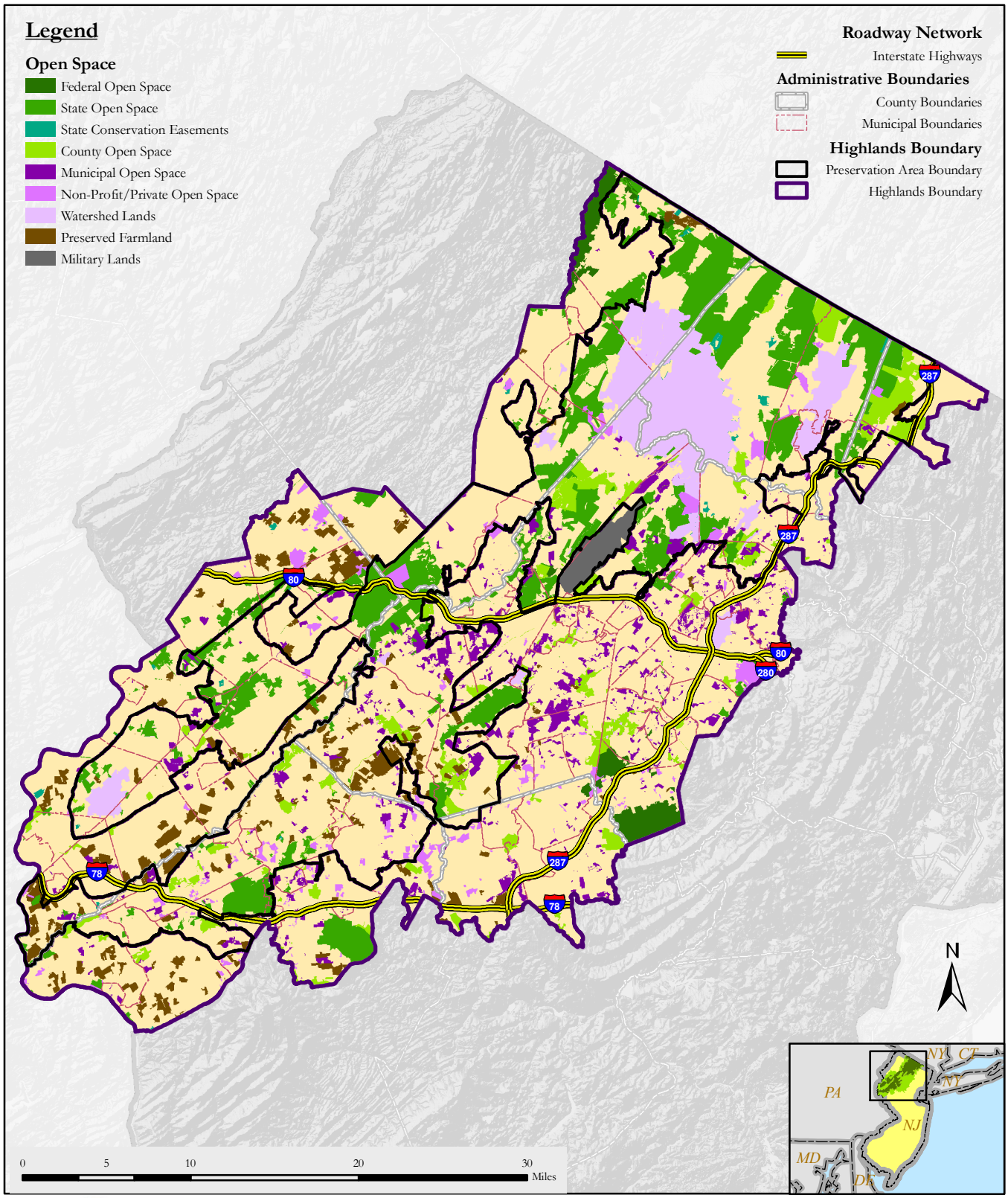
North of the terminal moraine, widely occurring soil associations include Rockaway-Rock outcrop-Hibernia, Rockaway-Hibernia-Urban land association, Swartswood-Norwich-Wurtsboro association, Swartswood-Rock outcrop, and Edneyville-Parker-Rock outcrop. South of the moraine, commonly found soil associations include Parker-Edneyville-Califon, Edneyville-Parker-Califon, Parker- Edneyville, Bartley-Turbotville-Cokesbury, Washington-Bartley, Annandale-Washington-Califon, and Edneyville-Parker-Rock outcrop.

Hydric soils that occur throughout the Highlands are saturated, flooded or ponded long enough to develop anaerobic (i.e. low oxygen) conditions in the uppermost soil layers. They are an essential component of wetlands. Although the Highlands Region's hydric soils are most commonly found in low-lying areas, usually along waterways, there are also wetlands at higher elevations, which occur in depressions, on broad, level mountain tops, or as hillside seeps. Cokesbury soil, for example, is a hydric soil commonly accompanied by a fragipan, a dense, nearly impermeable layer of material below the surface. Hydric soils in the Region may be formed from bedrock parent material, organic material, clay lake deposits, or in waterbody sediments.

10. Open Space

There is a long history of public and private investment for the purpose of preserving significant lands within the Highlands Region (See figure *Highlands Open Space*). Of the nearly 860,000 acres in the Highlands Region, a total of 274,675 acres (32%) are considered open space lands or farmlands and are held in a combination of federal, state, county, municipal, nonprofit, and private ownership (See table *Open Space in the Highlands Region*). These lands are in various forms of protection and include public and private lands and watershed areas, lands available for active and passive recreation, conservation areas dedicated to the preservation of natural and cultural resources, and preserved farmland.

Highlands Open Space



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Highlands Council
New Jersey

Sources:
New Jersey Highlands Council, 2006
Hunterdon County Division of GIS 2005
Green Acres Program, NJ DEP, 2001
Morris County Planning, Development & Technology, 2005
National Park Service, 2001
New Jersey Conservation Foundation, 2005
New Jersey Department of Agriculture SADC, 2006
Somerset County GIS, 2005
Sussex County Office of GIS Management 2005
The Nature Conservancy, 2004
US Fish and Wildlife Service, 2001
County of Warren Department of Planning, 2005

Open Space in the Highlands Region

Ownership	Area (Acres)	Percent
Federal	10,798	3.9%
Federal – Military	5,592	2.0%
State	100,403	36.6%
State-Conservation Easements	1,707	0.6%
Watershed	50,207	18.3%
County	32,015	11.7%
Municipal	30,138	11.0%
Preserved Farms	28,765	10.5%
Non-Profit	15,050	5.5%
Total	**274,675**	**31.9%**

Of these 274,675 acres, 186,211 acres (68%) of these lands are located in the Preservation Area and the remaining 88,464 acres are situated in the Planning Area. As of 2002, these lands included active recreation (4,207 acres, 15%), agriculture (28,320 acres, 10%), forest (174,011 acres, 63%), water (18,416 acres, 7%), wetlands (39,659 acres, 14%) with the remainder consisting of developed lands. Most, but not all, of these open space lands inventoried by the Highlands Council are permanently preserved through acquisition or easement. The federal military lands at Picatinny are predominantly in a natural state and have restricted public access; however, a portion of these lands have the potential for development in the future. In addition, some of the inventoried county properties and watershed lands may also not be permanently preserved. However, it is anticipated that county, municipal and non-profit land holdings are underreported

11. Land Use Characteristics

Patterns of human development have shaped the land use of the Highlands Region. By examining existing development patterns in conjunction with features of the natural environment, one can gain an understanding of the implications of past development activities, future development opportunities, and resource restoration or enhancement needs.

The composition of land use indicates that upland forest lands are dominant representing approximately 47 % of the Region; forest comprise over 61% of the Preservation Area as compared to approximately 33% of the Planning Area (See table *Composition of Land Use within the Highlands Planning and Preservation Area*). The second prominent land use representing 18% of the Region is residential lands; residential lands account for 12% of the Preservation Area and approximately 24% of the Planning Area. Agricultural lands comprise of approximately 13% of the land use for the Region and 17% of the land use for the Planning Area as compared to approximately 8% of the Preservation Area. Wetlands represent approximately 10% of the Region and are in similar proportions in both the Planning (11.2%) and Preservation Area (9.7%). Overall, the regional land use patterns indicate predominately forested lands with mostly residential housing.

Composition of Land Use within the Highlands Planning and Preservation Area

Land Classification	Highland Planning Area		Highland Preservation Area		Total Highlands	
	Area (acres)	Percent	Area (acres)	Percent	Area (acres)	Percent
Residential	104,929	23.6%	50,172	12.1%	155,101	18.0%
Commercial	12,687	2.9%	2,293	0.6%	14,980	1.7%
Industrial	6,649	1.5%	2,208	0.5%	8,857	1.0%
Other Urban	29,814	6.7%	10,944	2.6%	40,758	4.7%
Agriculture	75,319	16.9%	34,362	8.3%	109,681	12.8%
Forest	148,119	33.3%	254,288	61.3%	402,407	46.8%
Water	14,118	3.2%	18,411	4.4%	32,529	3.8%
Wetlands	49,663	11.2%	40,426	9.7%	90,089	10.5%
Barren Land	3,095	0.7%	1,871	0.5%	4,966	0.6%

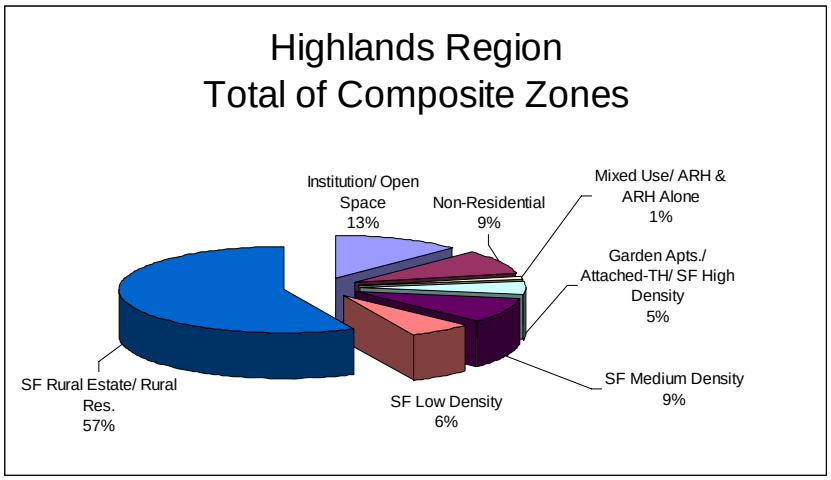
Approximately 220,000 acres (26%) of the Highlands Region were classified as developed land in 2002, and 18% of those developed lands are residential land uses (See table *Developed Lands in the Highlands Region (2002)).* The Planning Area represents approximately 35% of the regional developed lands as compared to approximately 16% of the Preservation Area. Of the remaining 640,000 acres of undeveloped land, 54% was located in the Preservation Area. Approximately 31%, of the Region or 270,000 acres, are public lands, such as roads, right-of-ways, water (lakes, rivers and streams), or dedicated federal, state or local open space areas (parks, public golf courses and preserved farms). Approximately 31% of Highlands residents currently live within ¾ mile from a bus stop, and 17% live within 1 mile of a train station. About half the population of the Region is currently served by wastewater infrastructure and there are approximately 9,000 acres of existing residential land at the minimum Transfer of Development Rights Program density of 5 dwelling units per acre, as required by the Highlands Act.

The nature of developed lands changes throughout the Region, ranging from 16 to 36% of the Highlands portion of the seven counties. The two towns in Bergen County and 32 towns in Morris County represent 36% developed lands with residential lands as the dominant land use type. The 5 towns in Somerset County represent 34% developed lands mostly as residential land uses and no developed industrial lands. The 15 towns in Hunterdon County represent 23% developed lands with again residential as the dominant land use and no existing developed industrial lands. The 10 towns in Sussex County represent 19% developed lands, the 19 towns in Warren County represent 17% developed lands, and the 5 towns in Passaic represent 16% developed lands all with residential land use as the dominant feature. The nature of developed lands throughout the Region depict a sparsely populated, forested and environmentally sensitive land area with minimal commercial and industrial activities.

Developed Lands in the Highlands Region (2002)

County	**Total Acres**	**Residential**		**Commercial**		**Industrial**		**Other**		**Total Developed Lands**	
		Acres	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Bergen County	22,398	5,390	24%	636	3%	547	2%	1,462	7%	8,035	36%
Hunterdon County	128,909	21,996	17%	1,376	1%	555	0%	5,346	4%	29,273	23%
Morris County	275,611	68,286	25%	7,952	3%	4,308	2%	17,486	6%	98,032	36%
Passaic County	83,853	9,871	12%	889	1%	511	1%	2,124	3%	13,395	16%
Somerset County	47,628	11,538	24%	912	2%	222	0%	3,685	8%	16,357	34%
Sussex County	129,864	18,058	14%	1,301	1%	1,184	1%	4,535	3%	25,078	19%
Warren County	171,096	19,961	12%	1,913	1%	1,529	1%	6,119	4%	29,522	17%
Total	**859,358**	**155,101**	**18%**	**14,980**	**2%**	**8,857**	**1%**	**40,758**	**5%**	**219,694**	**26%**

The Highlands Council also compiled municipal zoning information from the 88 Highlands municipalities as of November 2005. The 1,304 individual municipal zones in the Region were consolidated into 14 Highlands Composite Zones (See map *Highlands Composite Zoning*). Nearly 490,000 acres, or 57% of all land in the Highlands, is zoned as Single-Family (SF) Estate Residential or Single-Family Rural Residential (See figure *Highlands Region Total of Composite Zones*). Institutional/Open Space zones, which include open space, parks, and other civic uses, represent 108,000 acres or 13% of all zoned land in the Highlands Region. Non-Residential and SF Medium Density Composite zones each account for 9% of the area of the Region. The Mixed Use/Age Restricted Housing zone represents less than 1% or about 11,000 acres. The composite zone types for the Planning Area are generally characterized as having more lands which fall into residential zones of higher density. Conversely, within the Preservation area, Single-Family Estate Residential and Single-Family Rural Residential zones accounts for over 80% of the land.



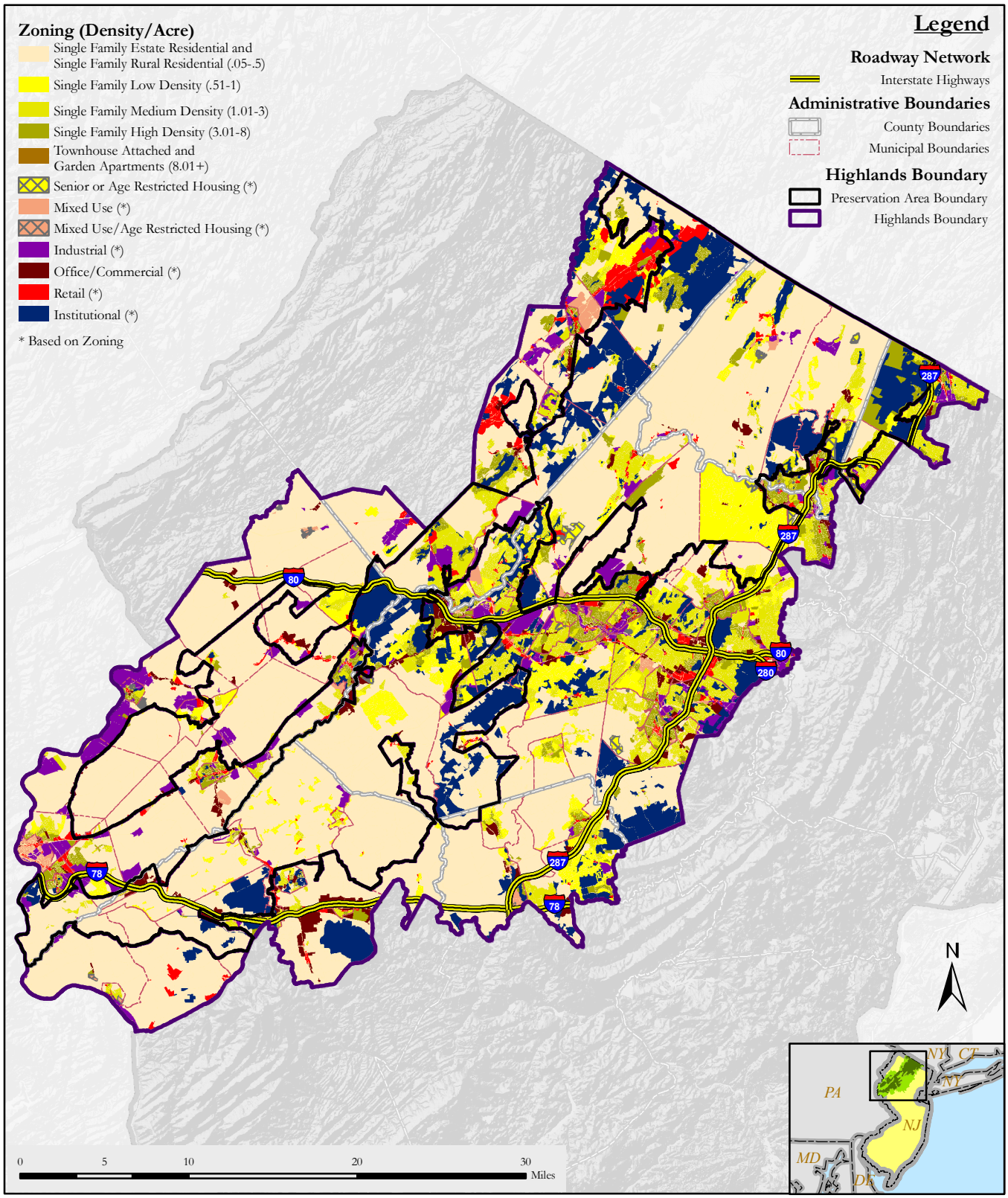
12. Land Use Change

As of 2002, the Highlands Region contained approximately 220,000 acres of developed land representing an increase of approximately 42,000 acres of urban land since 1986 (See table *Land Use Change between 1986 and 2002*, and figure *Change of Land Use (1986-2002)).* This represents an average annual increase of 2,629 acres of urban lands. In evaluating Land Use/Land Cover change over the time periods of 1986, 1995, and 2002, the loss of agricultural and forested lands to urban development throughout the Highlands Region was quite evident. Between 1986 and 2002, agriculture lands decreased by approximately 19% at an annual rate of approximately 1,700 acres, and forest lands decreased by nearly 1,000 acres annually or 4% since 1986.

Land Use Change between 1986 and 2002

Land Use	Total Acres			1986- 1995 Change		1995-2002 Change		1986-2002 Change		Average Annual Change (Acres)
	1986	1995	2002	Acres	%	Acres	%	Acres	%	
Urban	176,135	197,949	218,202	21,814	12%	20,253	10%	42,067	24%	2629
Agriculture	145,743	128,639	118,184	-17,104	-12%	-10,455	-8%	-27,559	-19%	-1722
Forest	417,621	412,004	402,244	-5,617	-1%	-9,760	-2%	-15,377	-4%	-961

Highlands Composite Zoning

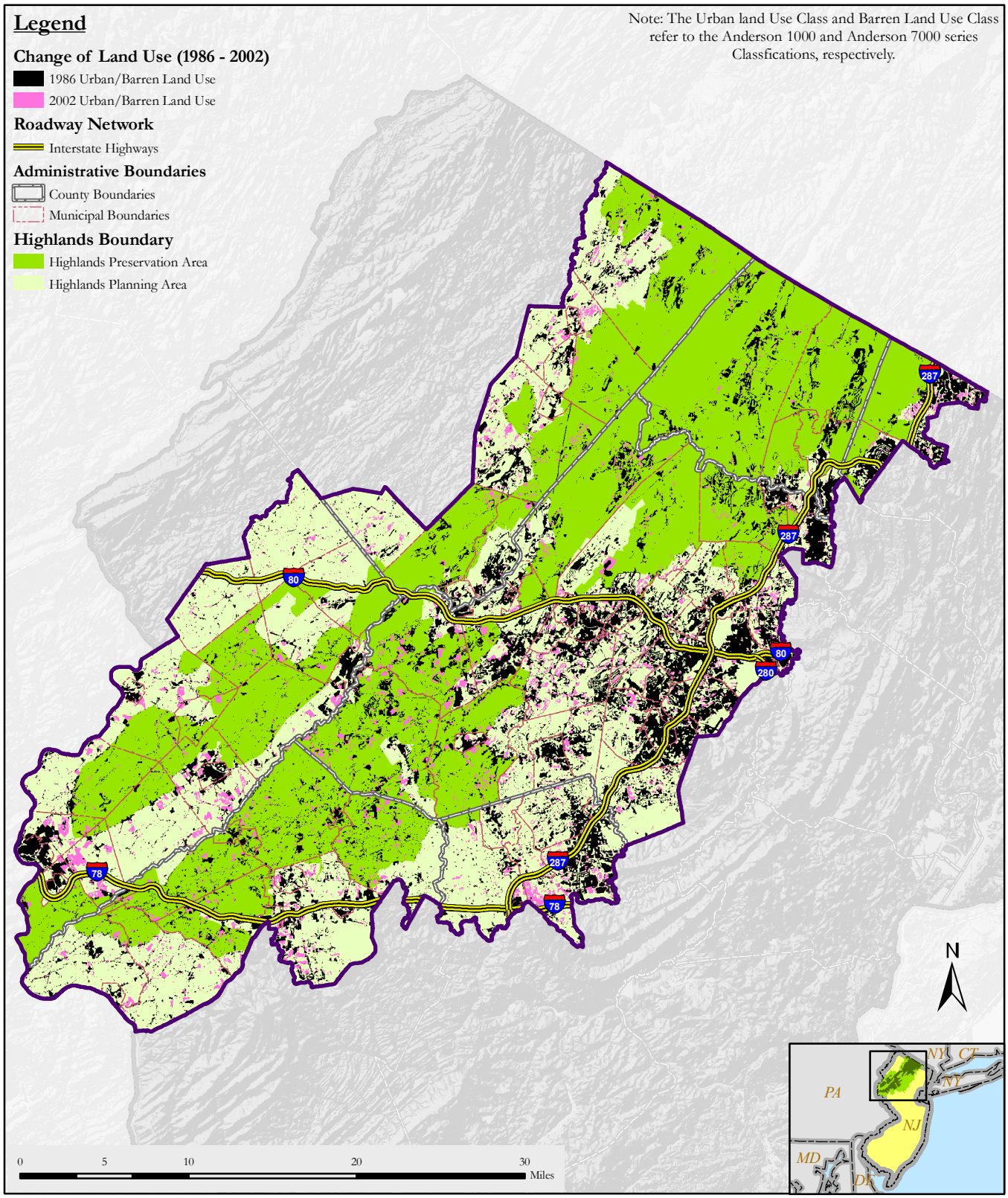


Draft Regional Master Plan, November 2006

Highlands Council
New Jersey

Sources:
New Jersey Highlands Council, 2006
(Based on Municipal Zoning 11/2005)

Change of Land Use (1986-2002)



Draft Regional Master Plan, November 2006

Highlands Council
New Jersey

Sources:
New Jersey Highlands Council, 2006
(Based on NJDEP Land Use/Land Cover Data)

D. Socio-Economic Characteristics

The Highlands Region is a unique and dynamic place with distinct physical features, valuable natural resources, a diverse population, and vital economy. The Region encompasses a wide spectrum of land uses and activities, from rural areas with small towns and open spaces, to employment centers characterized by urban densities and accessibility to major interstate transportation networks. Its proximity to recreational areas, including lakes, rivers, mountain trails as well as its short relative distance from the greater metropolitan area, are part of what makes the Highlands Region a desirable place to live.

This section describes socio-economic characteristics that define the Highlands Region, including population, income, housing, and employment. To understand the context of the Highlands Region economic trends, the evaluation also includes statewide data. The information was collected from both the United States Census Bureau and the Department of Labor and Workforce Development. By monitoring socio-economic patterns, a greater understanding can be developed of the relationship between people, jobs, markets, and the forces shaping the regional economy.

1. Population

There were approximately 821,547 people living in the 88 municipalities comprising the Highlands Region in 2004, an increase of 2.1% since the 2002 (See table *1990-2004 Population Estimates for the Highlands Region*). Between 2000 and 2004, the Highlands Region grew by 4.4%, and between 1990 and 2004, the Region saw an increase of about 126,000 people or 18%. The statewide population grew more slowly over the same 14-year period, increasing by about 12% from 7,730,188 in 1990 to 8,685,166 in 2004.

1990-2004 Population Estimates for the Highlands Region

Geography (Counties include only portions in Highlands Region)	**1990**	**2000**	**2002**	**2004**	**% Change**
Highland Total	695,489	786,363	804,790	821,547	18.1%
Bergen	29,961	36,674	37,686	38,389	28.1%
Hunterdon	51,040	58,455	60,191	61,575	20.6%
Morris	350,902	395,685	401,641	409,806	16.8%
Passaic	65,809	67,495	69,248	70,514	7.1%
Somerset	33,611	44,164	45,185	46,280	37.7%
Sussex	81,647	91,122	93,911	95,716	17.2%
Warren	82,519	92,768	96,928	99,267	20.3%
New Jersey	7,730,188	8,414,350	8,567,089	8,685,166	12.4%

Source: United States Census (Note: the table includes only those portions of each county falling within the Highlands Region)

2. Housing

Housing in the Highlands Region is characterized by a diverse mix of older houses in smaller municipalities, to more modern housing recently constructed in suburban and rural developments, as well as some infill developments. Approximately half of the municipalities in the Highlands Region have housing stock whose median age is 40 years or older. Many of the municipalities with older housing stock also have a higher than average number of rental

units. Monitoring housing units is useful in order to better understand the regional and local housing supply, and to see where new units are being added and at what rate. The table *1990 & 2000 Housing Units* is based on United States Census data and shows total housing units for the State, Highlands Region, and county portions of the Highlands Region for the years 1990 and 2000.

Between 1990 and 2000, New Jersey increased its total number of housing units by 234,965, from 3,075,310 to 3,310,275. The Highlands Region added 33,441 housing units during the same period; when measured by percentage, however, the Highlands Region increased housing units by 12.7% compared to the State's 7.6%. Morris County added the greatest number of housing units (16,541) while Somerset County had the greatest growth by percentage (28%). Passaic County had the smallest increase in housing units measured both by number (811) and by percentage (3.4%).

1990 & 2000 Housing Units

Geography (Counties Include Only Portions in Highlands Region)	**1990**	**2000**	**Change**	**% Change**
Highlands Total	263,102	296,543	33,441	12.7%
Bergen	11,268	13,922	2,654	23.6%
Hunterdon	18,429	20,563	2,134	11.6%
Morris	130,393	146,934	16,541	12.7%
Passaic	23,783	24,594	811	3.4%
Somerset	14,070	18,014	3,944	28.0%
Sussex	31,891	35,163	3,272	10.3%
Warren	33,268	37,353	4,085	12.3%
New Jersey	3,075,310	3,310,275	234,965	7.6%

Housing vacancy rates serve primarily as an indication of the supply of available rental units, and serves as another measure of housing market performance. In New Jersey, the total number of vacant units decreased by 34,969 or -12.5%.

The Highlands Region experienced a decline in vacant housing units of 4,634 or -27.3%. Morris County experienced the largest decrease in number of vacant units (-2,190) while Bergen County had the greatest decrease by percentage (-41.7%). Warren County had both the smallest decrease in number of vacant units (-58) and percent change (-2.5%). One explanation for the decrease in vacant housing units both in the Highlands Region and the State is that demand for housing exceeded supply. For example, a statewide increase in population (684,000) and new households (515,959) during the same period was not mirrored by the overall increase in total new housing units (234,965). For this reason, demand for housing in the State has pushed greater occupancy and hence a decrease in vacant housing, which may also reflect similar trends in the Highlands Region.

3. Income

Between 1990 and 2000, per capita income in New Jersey rose by roughly 44.3% from $18,714 to $27,006. During the year 2000, New Jersey was the second wealthiest state in the United States, behind only Connecticut ($28,766).

During the same 10-year period, the per capita income of the Highlands Region was up by 48% from $22,609 to

$33,400. Somerset County had the greatest per capita growth of all Highlands counties increasing by more than 60% between 1990 and 2000. Passaic County had the least relative per capita growth, increasing by 44.5% during the same period. Per capita income growth in the Highlands Region and its county portions all increased more than the State as a whole during the same 10-year period.

Somerset County had the highest per capita income in the Highlands Region at $63,600. This is nearly twice the per capita income of the total Highlands Region ($33,400) for the same year. Passaic, Sussex, and Warren counties had per capita income of $27,979, $27,803, and $26,523, respectively, each below that of the entire Highlands Region ($33,400).

Median household income is another measure of private wealth which is often seen as the most dependable measure of personal wealth, as people tend to live in households that include other wage earners. The table *1990 & 2000 Median Household Income* is based on United States Census data for the State, Highlands Region, and county portions of the Highlands Region for the years 1990 and 2000 (note: municipal median values were averaged for the Highlands Region and its county portions). Between 1990 and 2000, median household income in New Jersey rose by about 34.7% from $40,927 to $55,146. By this measure, New Jersey was the wealthiest state in the nation during the year 2000. From 1990 to 2000, the Highlands Region median household income grew by 25% from $58,078 to $72,999. Somerset County had the greatest growth of all Highlands counties during the period, growing by 32%. Morris County had the least growth in median household income of all Highlands counties, growing by 23.8% during the same period. Median household income for the Highlands Region was 34% greater than that of the State. While the overall State median household income grew faster than any of the Highlands counties, the actual values in all Highlands counties were greater than the State values.

1990 & 2000 Median Household Income

Geography (Counties Include Only Portions in Highlands Region)	**1990**	**2000**	**Change**	**% Change**
Highlands Region	$58,078	$72,999	$14,920	25.0%
H-Bergen	$65,293	$83,065	$17,772	27.2%
H-Hunterdon	$64,158	$82,985	$18,827	30.9%
H-Morris	$66,142	$81,698	$15,556	23.8%
H-Passaic	$55,332	$71,081	$15,749	28.4%
H-Somerset	$75,500	$99,046	$23,546	32.0%
H-Sussex	$53,580	$68,169	$14,589	26.3%
H-Warren	$47,544	$59,636	$12,092	25.2%
New Jersey	$40,927	$55,146	$14,219	34.7%

Somerset County had the highest median household income ($99,046) in the Highlands Region. This is about $26,000 greater than the median household income in the Highlands Region ($72,999) for the same year, and about $40,000 greater than the median household income of Warren County, which had the lowest median household income.

4. Employment

The New Jersey Department of Labor and United States Census Bureau identify two components for the labor force - employed population and unemployed population (See table *2004 Labor Force*). The average annual unemployment rate was 4.8% for the State as a whole and only 3.7% for the Highlands Region. Each county

portion of the Highlands Region showed unemployment rates below that of the State, with Somerset County the lowest, at 3.1%. The Highlands Region therefore shows stronger employment numbers than those exhibited statewide, representing a strong existing workforce.

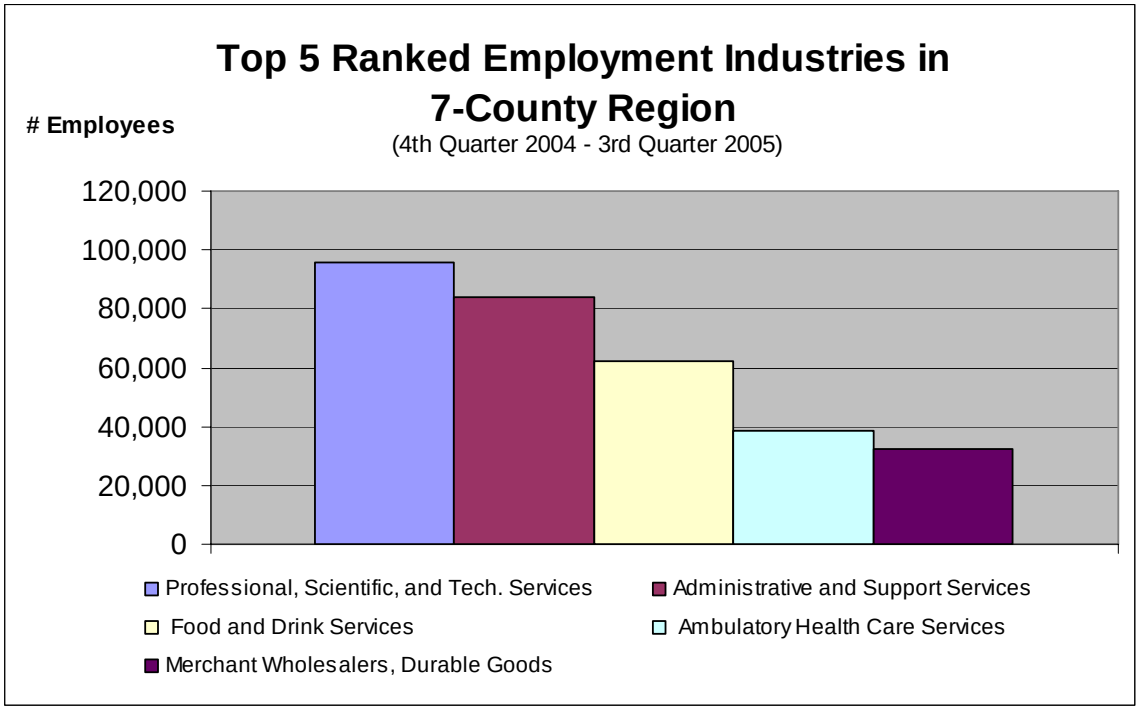
2004 Labor Force

Geography (Counties Include Only Portions in Highlands Region)	**Labor Force**	**Unemployment Rate**
Highlands Region	439236.8	3.7%
Bergen	18,413	3.4%
Hunterdon	32,185	3.3%
Morris	222,171	3.6%
Passaic	36,965	4.0%
Somerset	23,793	3.1%
Sussex	52,554	4.0%
Warren	53,157	4.3%
New Jersey	4,388,000	4.8%

The figure entitled *Top 5 Ranked Employment Industries in 7-County Region (4th Quarter 2004 - 3rd Quarter 2005)* represents a seven-county region that includes Bergen, Hunterdon, Morris, Passaic, Somerset, Sussex, and Warren Counties (note: for this discussion each of the counties were included in their entirety; not just their Highlands portions). Professional, Scientific, and Technological Services, which require a high degree of expertise and training, employed the greatest number of workers in the seven-county region with roughly 96,000 employees. The next largest industry, in terms of number of employed, were Administrative and Support Services comprising 85,000 employees. Food Services and Drinking Places employed roughly 62,000, and Ambulatory Health Care Services and Merchant Wholesalers, Durable Goods accounted for 39,000 and 33,000 employees, respectively.

The counties included in the seven-county region were also examined individually in order to assess job market variations. The top five industries in Bergen County are the same as the top five industries for the seven-county region. Morris and Passaic counties share four of the top five industries in the seven-county region with the exceptions being the Insurance Carriers and Hospital industries, respectively. Somerset, Sussex, and Warren counties share three of the top five ranks as the seven-county region and Hunterdon shares only two of the top five ranks. These four counties represent additional high ranked employment opportunities in the fields of Nursing and Residential Care Facilities, Corporate Management, Chemical Manufacturing and Merchant, Wholesalers, Nondurable Goods as compared to the rest of the seven-county region.

During Quarter 2004 - 3rd Quarter 2005 period, the fastest growing industry was Food and Beverage Stores, which was not among the five largest industries for the seven-county region. The next fastest growing industries in order from greatest to least include the following: Food and Drink Services; Ambulatory Health Care Services; Professional, Scientific, and Technological Services; and Merchant Wholesalers, Nondurable Goods.



Projections for 2014, developed by the New Jersey Department of Labor's Division of Labor Market and Demographic Research, are the latest long-term projection of population, labor force, and employment in the State. The study projects professional and related industries as well as other service industries to be the largest contributors to new jobs and job growth in the State from 2004 - 2014. This study is reflected by similar trends in the Highlands Region, with professional and service industries accounting for the vast majority of jobs and job growth. Regional employment growth opportunities are positive.